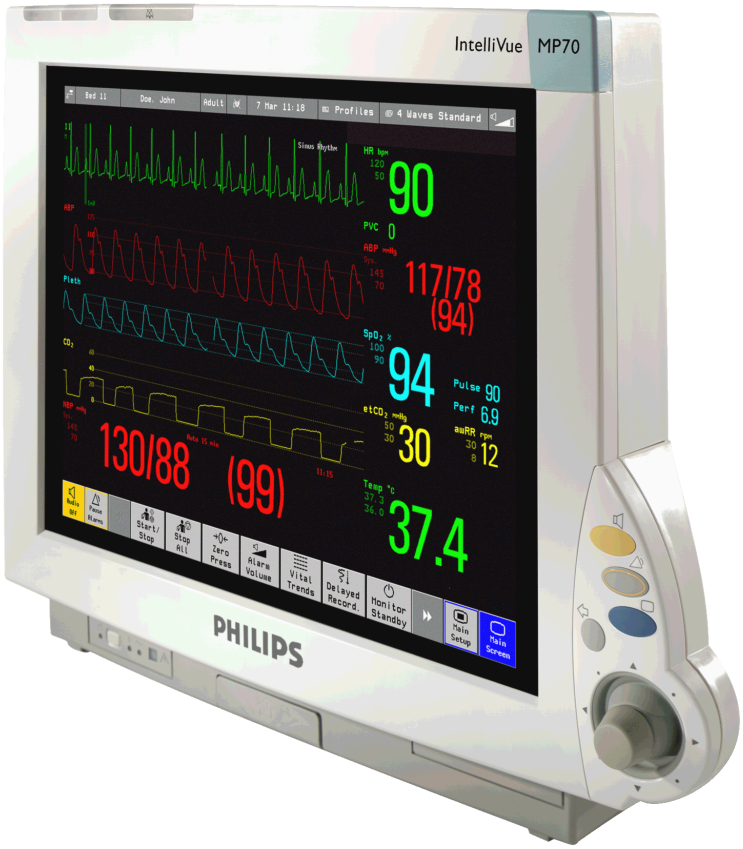

Service Guide

IntelliVue Patient Monitor

MP60/70

Patient Monitoring

PHILIPS

Part Number M8000-9301A

PHILIPS

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1

Introduction

This Service Guide contains technical details for the IntelliVue MP60 and MP70 Patient Monitor, the Multi- Measurement Server (MMS), the Flexible Module Server (FMS) and the Measurement Server Extensions.

This guide provides a technical foundation to support effective troubleshooting and repair. It is not a comprehensive, in-depth explanation of the product architecture or technical implementation. It offers enough information on the functions and operations of the monitoring systems so that engineers who repair them are better able to understand how they work.

It covers the physiological measurements that the products provide, the Measurement Server that acquires those measurements, and the monitoring system that displays them.

Who Should Use This Guide

This guide is for biomedical engineers or technicians responsible for troubleshooting, repairing, and maintaining Philips' patient monitoring systems.

How to Use This Guide

This guide is divided into eight sections. Navigate through the table of contents at the left of the screen to select the desired topic. Links to other relevant sections are also provided within the individual topics. In addition, scrolling through the topics with the page up and page down keys is also possible.

Abbreviations

Abbreviations used throughout this guide are:

Name	Abbreviation
IntelliVue MP60/MP70 Patient Monitor	the monitor
Flexible Module Server	FMS
Multi-Measurement Server	MMS

Responsibility of the Manufacturer

Philips only considers itself responsible for any effects on safety, reliability and performance of the equipment if:

- assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by Philips, and
- the electrical installation of the relevant room complies with national standards, and
- the instrument is used in accordance with the instructions for use.

To ensure safety, use only those Philips parts and accessories specified for use with the monitor. If non-Philips parts are used, Philips is not liable for any damage that these parts may cause to the equipment.

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Hewlett-Packard Str. 2

71034 Böblingen, Germany

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Passwords

In order to access different modes within the monitor a password may be required. The passwords are listed below.

Monitoring Mode: No password required

Configuration Mode: 71034

Demo Mode: 14432

Service Mode: 1345

Consult the configuration guide before making any changes to the monitor configuration.

2

Theory of Operation

Integrated Monitor Theory of Operation

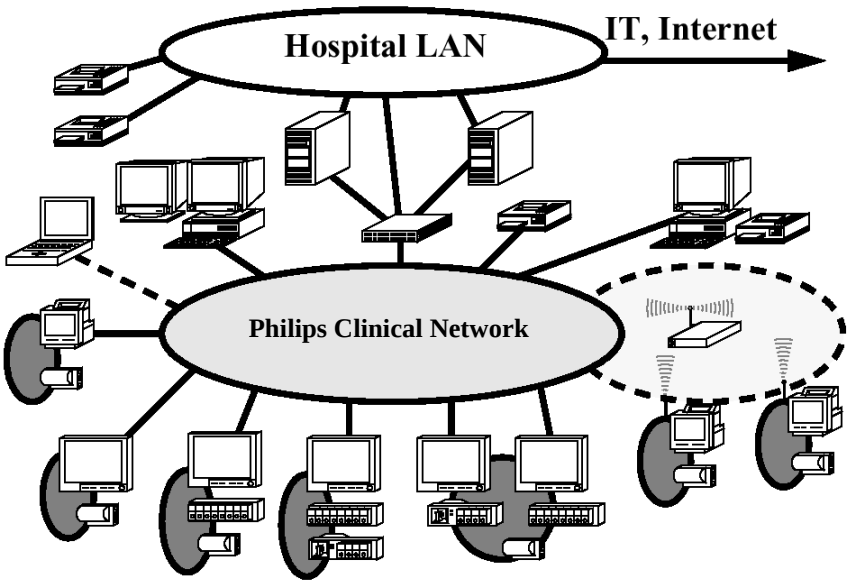
The IntelliVue Patient Monitor:

- displays real-time data
- controlls the attached measurement servers
- alarms in the case of patient or equipment problems
- offers limited data storage and retrieval (trending)
- interfaces to the Philips Clinical Network and other equipment

A monitor with just a single integrated measurement server can be connected to additional building blocks to form a monitoring system with a large number of measurements, additional interface capabilities and multiple slave displays. These elements cooperate as one single integrated real-time measurement system.

System Boundaries

The following diagram discusses specific boundaries within the overall system with respect to their openness and real-time requirements:



	Measurement LAN combines components of one patient monitor; real time requirements across all interconnected elements
	Philips Clinical Network (wired LAN) connects multiple patient monitors, information centers, application servers; closed system, only Philips qualified products (tested and with regulatory approval) are connected, Philips is responsible for guaranteed real-time functionality and performance
	Philips Clinical Network (wireless) like Philips Clinical Network (wired) LAN, however due to current wireless technologies available it has reduced bandwidth, longer latencies, reduced functionality
	Hospital LAN, Internet Standard Network, not under Philips control, no guaranteed service, no real-time requirements

Hardware Building Blocks

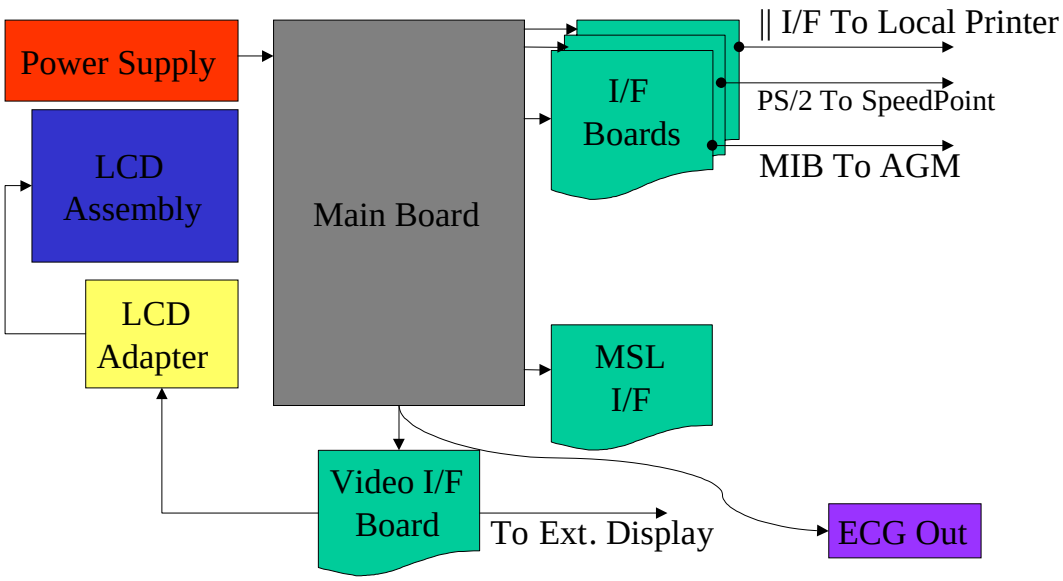
The following hardware building blocks make up the monitoring system:

IntelliVue MP60

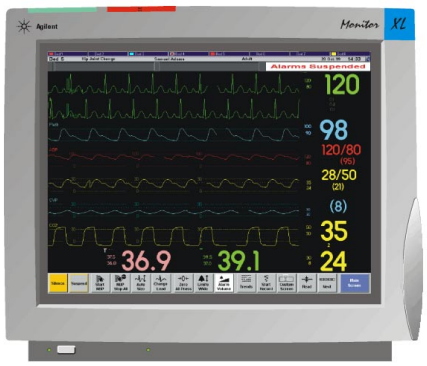
The MP60 monitor:

- integrates the display and processing unit into a single package
- uses a 15” TFT XGA Color display
- uses the Philips SpeedPoint as primary input device; computer devices such as mice, trackball, and keyboard can be added optionally
- has an optional recorder
- supports the Flexible Module Server (FMS)

Building Blocks:



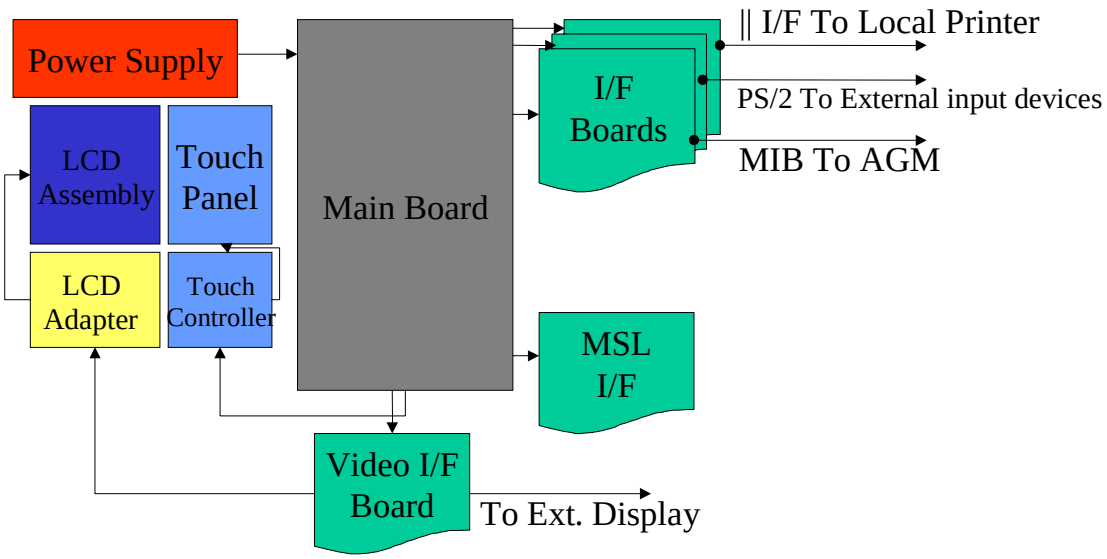
IntelliVue MP70



The MP70 monitor:

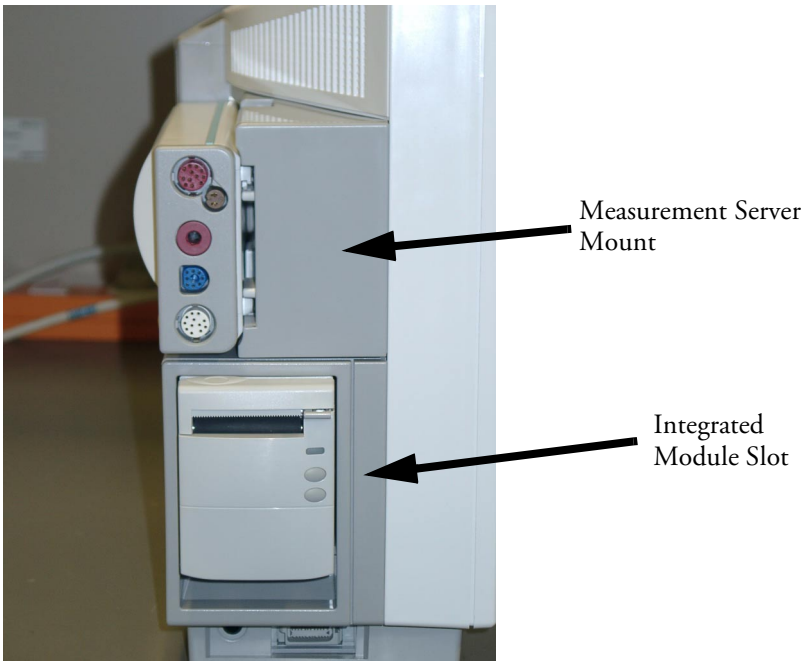
- integrates the display and processing unit into a single package,
- uses a 15” TFT XGA Color display
- uses the Philips Touchscreen as primary input device, whereas the Philips SpeedPoint and computer devices such as mice, trackball, and keyboard can be added optionally
- has an optional recorder
- supports the Flexible Module Server (FMS)

Building Blocks:



Optional Hardware

A measurement server mount and /or an integrated module slot can be ordered optionally.



Compatible Devices

Figure 1 M8048A Flexible Module Server (FMS)

Figure 2 M3001A Multi-Measurement Server (MMS)

Power Supply

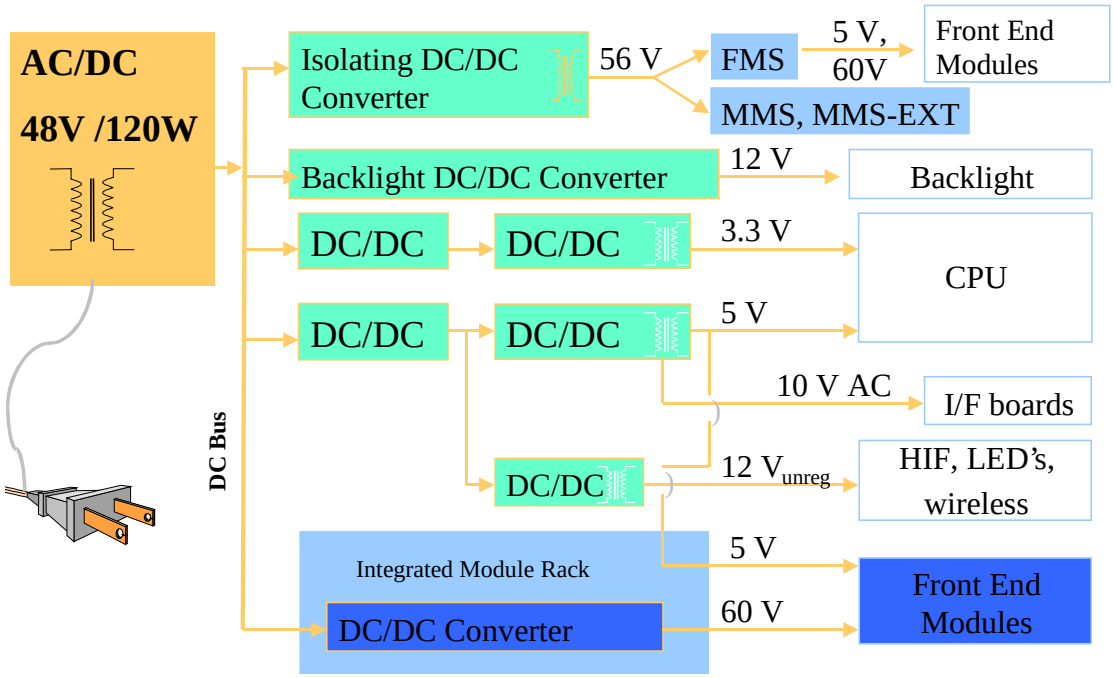
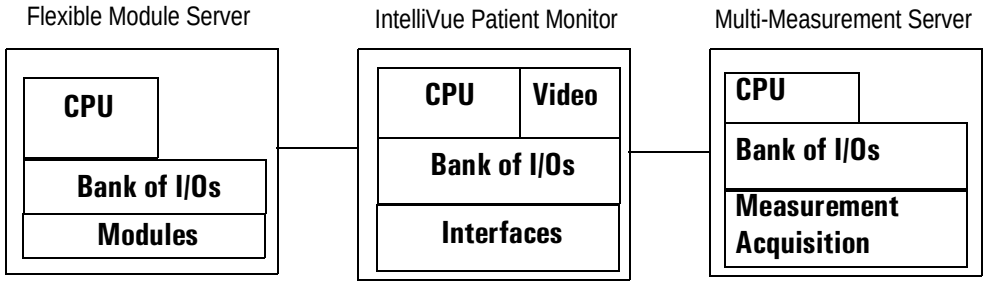


Figure 3 Power Supply Architecture

The AC/DC converter transforms the AC power coming from the power plug into 48 V/120W DC source and isolates the monitoring system from the AC power mains.The 48V is distributed via power bus and supplies power to all the components of the system: The 56 V DC power needed for the FMS, MMS and measurement server extension is created by an isolating DC/DC converter. The power needed for the backlights is converted to 12V DC by the backlight DC/DC converter. The CPU is supplied with 3.3 V and 5 V DC power. The transformation is performed in two steps: The first DC/DC converter is a power regulator which reduces the variations caused by load changes on the 48V power bus. The second DC/DC converter converts the power to the needed voltage. Interface boards require a power of 10V DC. The HIF board and the LEDs are supplied with 12V DC unregulated power. The integrated module slot requires a 5 V supply for the modules slots and uses the 48V and another DC/DC converter to create 60 V in order to supply power for the modules.

CPU Boards

The CPU boards have an MPC860 50 MHz processor that provides a number of on-chip, configurable interfaces. An array of 12 fast UARTS with configurable protocol options are implemented in an ASIC (along with other system functions such as independent watchdogs etc.), providing interfacing capabilities to measurement modules and I/O boards. The serial interfaces can easily be electrically isolated. The main board contains additional video hardware.



The CPUs provide two LAN interfaces to interconnect CPUs (via the Internal LAN) or to connect to the Philips Clinical Network.

The CPU capabilities are identical. Different loading options are coded on serial EEPROMs to support the automatic configuration of the operating system at boot time.

I/O Boards

Interfaces to the monitor are implemented via I/O boards. The location of these boards is restricted by general rules. The I/O slot designations diagram and the I/O matrix which outline the I/O board placement rules can be found in the *Installation Instructions* section.

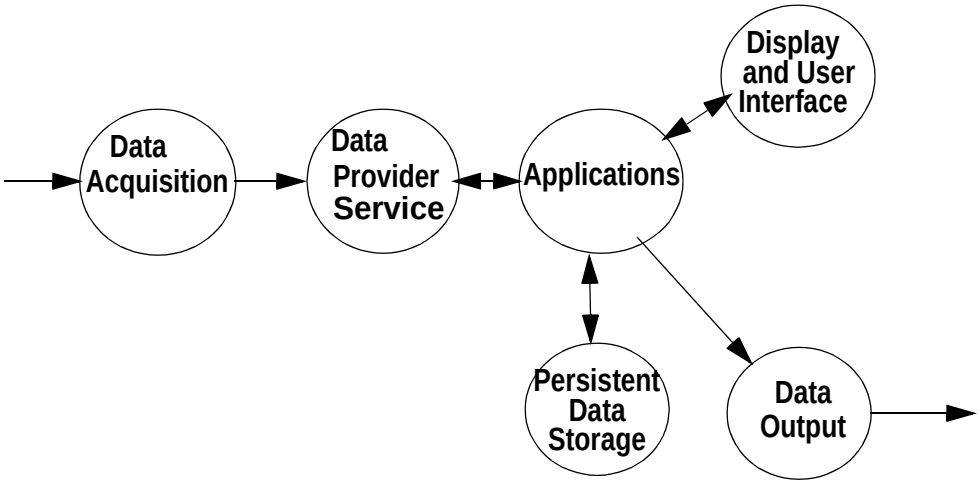
The following is a list of Interface (I/O) boards which may be present in your monitor, depending on your purchased configuration:

- MSL
- Video (analog)
- Philips Clinical Network (LAN)
- PS/2
- MIB/RS232
- Flexible Nurse Call
- Parallel printer
- Remote devices (Remote Alarm Device, Remote Extension Device)

The specifications for the above listed interfaces can be found in the technical data sheet for the monitor and in the *Specifications* chapter of the Instructions for Use.

Data Flow

The following diagram shows how data is passed through the monitoring system. The individual stages of data flow are explained below.



Data Acquisition

Monitoring data (for example patient measurement data in the form of waves, numerics and alerts) is acquired from a variety of sources:

- Measurement Servers

  The Measurement Servers connected to the internal LAN convert patient signals to digital data and apply measurement algorithms to analyze the signals.

- External measurement devices

  Data can be also acquired from devices connected to interface boards of the monitor. Software modules dedicated to such specific devices convert the data received from an external device to the format used internally. This applies to parameter modules and the Anesthetic Gas Module

- Server systems on the Philips Clinical Network

  To enable networked applications such as the other bed overview, data can be acquired from server systems attached to the Philips Clinical Network, for example a Philips Information Center

Data Provider System Service

All data that is acquired from measurement servers or external measurement devices is temporarily stored by a dedicated data provider system service. All monitor applications use this central service to access the data in a consistent and synchronized way rather than talking to the interfaces directly.

This service makes the applications independent of the actual type of data acquisition device.

The amount of data stored in the data provider system service varies for the different data types. for example several seconds of wave forms and the full set of current numerical values are temorarily stored in RAM.

Persistent Data Storage System Service

Some applications require storage of data over longer periods of time. They can use the persistent data storage system service. Dependent on the application requirements, this service can store data either in battery backed-up (buffered) memory or in flash memory. The buffered memory will lose its contents if the monitor is without power (not connected to mains) for an extended period of time. The flash memory does not lose its contents.

The trend application for example stores vital signs data in a combination of flash memory and buffered memory, while the system configuration information (profiles) is kept purely in flash memory.

Display and User Interface Service

Applications can use high level commands to display monitoring data or status and command windows on the internal LCD panel. These commands are interpreted by the display manager application. This application controls the dedicated video hardware which includes video memory and a special ASIC.

User input is acquired from a variety of input devices, for example the SpeedPoint, the touchscreen or other standard input devices (keyboard, mouse) which may be attached to I/O boards. The system software makes sure that the user input is directed to the application which has the operating focus.

Data Output

The monitoring system is very flexible and customizable regarding its data output devices. Built-in devices (for example LAN, alarm lamps, speaker, video) provide the basic output capabilities.

These capabilities can be enhanced by adding additional I/O boards, as required in the specific end-user setup. The additional I/O boards typically provide data to externally attached devices, for example to printers, RS232 based data collection devices, nurse call systems etc.

The monitor can identify I/O boards by means of a serial EEPROM device that stores type and version information. The operating system detects the cards and automatically connects the I/O board with the associated (interface driver) application. For some multi- purpose cards it is necessary to configure the card for a particular purpose first (for example the dual MIB/RS232 card can support external touch display, data import, data export).

Monitor Applications

The monitor applications provide additional system functionality over the basic measurement and monitoring capabilities. This includes for example trending, report generating, event storage or derived measurements.

In general, the monitor applications use the data provider system service to access the measurement data. Application interfaces to the other system services allow the application to visualize data, to store data over extended periods of time or to output data to other devices.

Internal LAN (Measurement Server Link)

All components of the monitoring system (including measurement servers and CPUs in the monitor) communicate using an IEEE802.3/ Ethernet LAN in the Measurement Server Link (MSL). This network is used to distribute data between the components, for example:

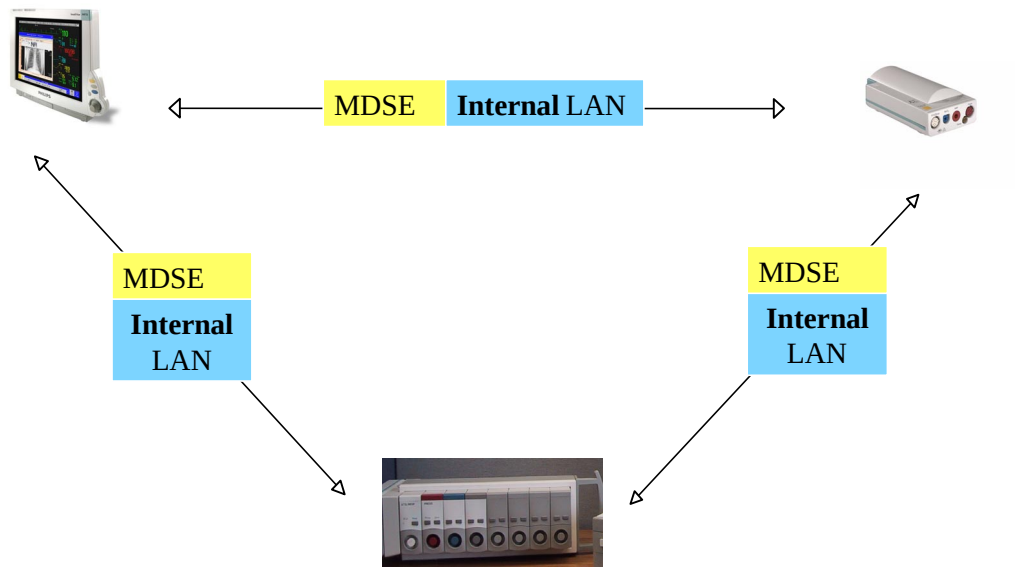
- Digitized patient signals including wave data, numerical data and status information (typically from the measurement server to a display unit)
- Control data representing user interactions (typically from the display unit to a measurement server)
- Shared data structures, for example representing patient demographical data and global configuration items

The internal LAN allows plug and play configuration of the monitoring system. The system automatically detects plugging or unplugging of measurement servers and configures the system accordingly.

The components on the internal LAN are time- synchronized to keep signal data consistent in the system. Dedicated hardware support for synchronization eliminates any latency of the network driver software.

The integrated LAN provides deterministic bandwidth allocation/ reservation mechanisms so that the real-time characteristic of signal data and control data exchange is guaranteed. This applies to the data flow from the measurement server to the monitor (for example measurement signal data) and the data flow from the monitor to a measurement server (for example to feed data to a recorder module).

Integrated communication hubs in the monitor and the FMS allow flexible cabling options (star topology, daisy chaining of servers).



Philips Clinical Network

The monitoring system may be connected to the Philips Clinical Network, for example to provide central monitoring capabilities or other network services. This connection may be through a normal wired connection or through a wireless connection.

The monitor supports the connection of an external off-the-shelf wireless adapter. This allows a simple field upgrade as well as a technology upgrade in the future. Switching between wired and wireless networks is automatically triggered by the plugging or unplugging of the network cable.

The Philips Clinical Network protocols function very similarly to the protocols used on the internal LAN.

After configuration, the monitoring system sends the digitized patient signals including wave data, numerical data and status information onto the network. Control data representing user interactions can be exchanged between the monitoring system and a central station bi-directionally.

Additional protocols are supported for networked applications, for example for the other bed overview function, which allows viewing of monitoring data from other patients on the network.

For plug and play operation, the monitoring system uses the standard BootP protocol to automatically acquire a network address.

How does the Support Tool Work with the Monitor

The support tool is an NT application typically installed on the laptop of a customer engineer or a biomedical engineer working in the customer's own service department.

The purpose of the support tool is to upgrade, configure and diagnose all monitoring components (modules, measurement servers, and monitors) in the system over the network. The monitors route network traffic between the Philips Clinical Network to the internal LAN.

The service protocol developed for this purpose uses a raw access to the devices without the need for IP addresses etc. over a standard customer network installation, so that even defective devices can be upgraded as long as the few kBytes of initial boot code are working. The boot code itself can also be upgraded using the same protocol.

The tool allows access to internal service information and to serial numbers. It can be remote-controlled, for example via a dial-up connection from a response center, provided the proper infrastructure is in place.

For details see the Instructions for Use for the Support Tool.

Monitor Software Block Diagram

Figure 4 shows the functional block diagram for the monitoring system. A legend explaining terms and diagram elements follows. The information below varies depending on the purchased monitor options.

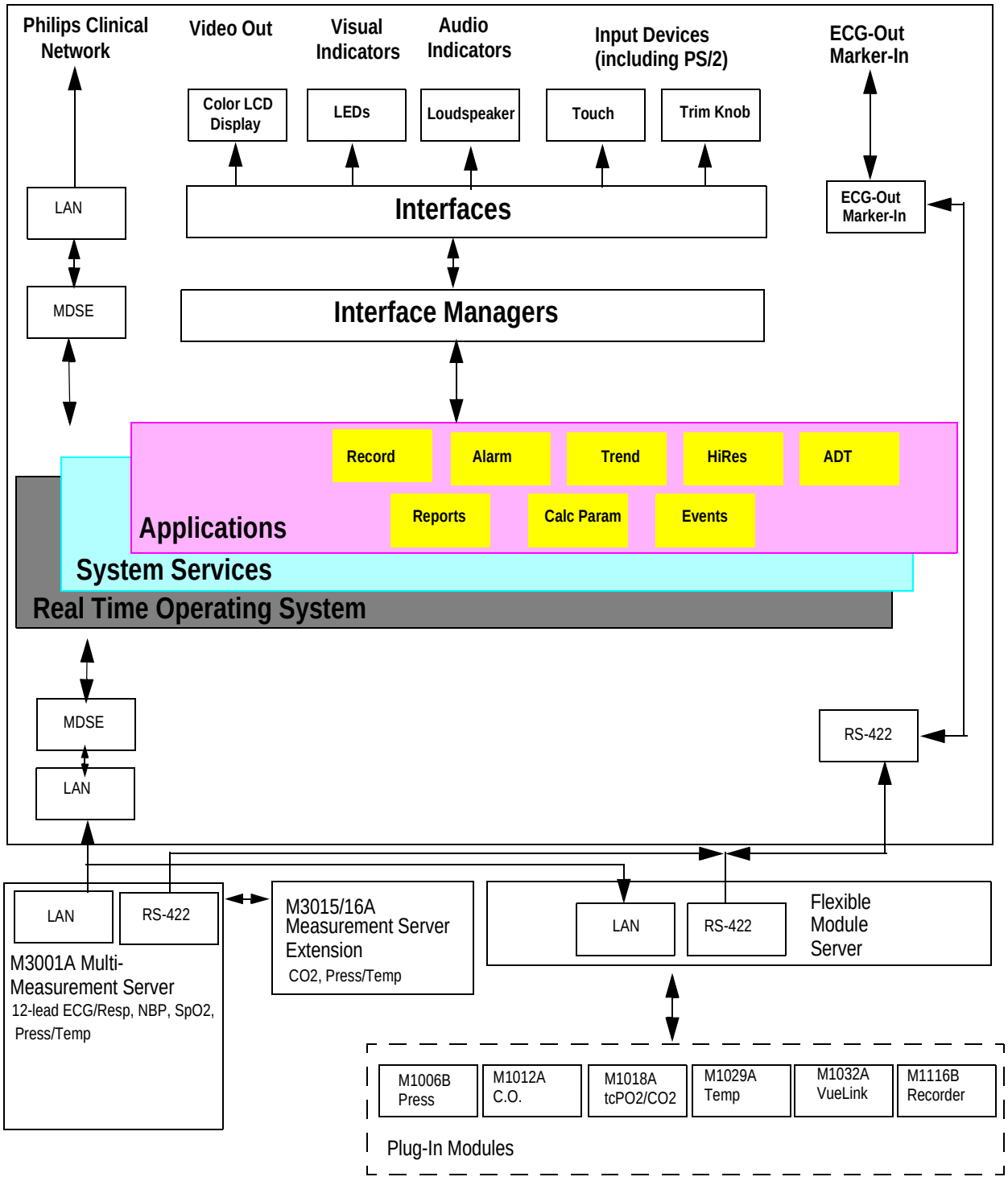


Figure 4 IntelliVue Patient Monitoring System Functional Block Diagram

Block Diagram Legend

Functional Block	Description
Services	
Operating System	The Operating System (OS) provides a layer of isolation between the specific hardware implementation and the application software. The OS performs system checks and allocates resources to ensure safe operation when the system is first started. This includes internal self-tests on several hardware modules and configuration checks for validity of configuration with the operating software. During normal operation, the OS continues to run checks on system integrity. If error conditions are detected the OS will halt monitoring operations and inform the operator about the error condition.
System Services	The System Services provide generic common system services. In particular: It uses a real-time clock component to track time. It synchronizes to network time sources and verifies the accuracy of the system time information. It is also responsible for managing persistent user configuration data for all Measurement Servers, Flexible Module Servers and IntelliVue Patient Monitoring System software modules. User configuration data is stored in a non-volatile read/write storage device
Applications	
Reports	The Reports Service retrieves current and stored physiological data and status data to format reports for printing paper documentation. The following reports are supported: • Vital Signs Report • Graphical Trend Report • Event Review Report • Event Episode Report • ECG Report (12 Lead/Multi-Lead) • Cardiac Output Report • Calculations Report (Hemodynamic/Oxygenation/ Ventilation) • Calculations Review Report • Wedge Report • Test Report • Other reports (e.g. Loops, Review Applications, Drug report) The Reports service generates report data which can be printed on a local or a central printer.

Functional Block	Description
Record	The Record Service retrieves current and stored physiological data and status data to format a continuous strip recording. A recording can be triggered manually by the operator or automatically by an alarm condition. The Record Service uses the services of the Recorder Interface to control an M1116B Recorder in the FMS. The Record Service can also send data to a central recorder.
Alarm	The Alarm Service contains logic that prioritizes alarm conditions that are generated either by the Measurement Servers, Flexible Module Server, or by IntelliVue Patient Monitoring System software modules. Visual alarm signals (messages) are displayed at the top of the IntelliVue Patient Monitoring System display and alarm sounds are generated by a loudspeaker. Alarm conditions may be generated when a physiological parameter exceeds preselected alarm limits or when a physiological parameter or any other software module reports an inoperative status (technical alarm, for example, the ECG leads may have fallen off the patient). The Alarm service manages the alarm inactivation states, for example suspension of alarms, silencing of alarms, and alarm reminder. Alarm signals may also be configured as latching (alarm signals are issued until they are acknowledged by the operator, even when the alarm condition is no longer true). The Alarm service controls the visual alarm signals (alarm lamps).
Trend	The Trend service stores the sample values of physiological data and status data with a resolution of 12 seconds, 1 minute or 5 minutes for a period of up to 48 hours. The data is kept in battery buffered read/write storage and flash memory devices to be preserved across power failures. The stored data is protected via consistency checks and checksums. When a new patient is admitted, the trend database erases all data of the previous patient.
HiRes	The OxyCRG (Oxygen CardioRespiroGram) service derives a high-resolution trend graph from the Beat-to-Beat Heart Rate, SpO_2 or $tcpO_2$, and Respiration physiological data. The OxyCRG is specialized for neonatal applications, allowing the opeartor to identify sudden drops in Heart Rate (Bradycardia) and SpO_2 or $tcpO_2$ (Desaturations), and supporting the operator in visualizing Apnea situations.
ADT	The ADT (Admit/Discharge/Transmit) service maintains the patient demographics information. The operator may admit a new patient, discharge the old patient and enter or modify the patient demographics. The ADT service also supports the transport of a patient (trend database) with the M3001A Multi-Measurement Server. The ADT service controls the deletion of old patient data, the upload of trend data from the M3001A and the switching back of all settings to user defaults. It also synchronizes patient information with a central station on the network.

Functional Block	Description
Calc Param	The Calc Param (Calculated Parameters) service accesses current, stored and manually entered physiological data as input to calculation formulas. With these formulas, derived hemodynamic, oxygenation and ventilation variables are computed. The calculation results, including the input parameters, are stored for later review using the Trend service.
Interface Managers	
MDSE	The MDSE (Medical Data Service Element) Interface Manager is responsible for the exchange of real-time data between the IntelliVue Patient Monitoring System display unit and the Measurement Servers and Flexible Module Server as well as between the IntelliVue Patient Monitoring System display unit and other devices attached to the network. MDSE establishes and maintains a data communication link between the devices. It provides configuration information about the remote device to applications in the local device and it allows the exchange of measurement data and status information between the devices.
Printer	The Printer Interface Manager provides a high level interface to a printer. It provides means to: • establish a connection to the printer • transfer data to the printer • get status of the printer • close connection to the printer The Printer Interface Manager also supervises the connection to the printer and whether the printer accepts data (for example paper out). The Printer Interface Manager notifies the operator in such cases.

Functional Block	Description
Display & Operator Interface	The Display and Operator Interface Manager performs the following tasks: • Screen presentation of real-time and stored physiological measurement data, alarm condition data and status information received from the MDSE interface manager, the Alarm service or other IntelliVue Patient Monitoring System modules • Screen presentation of operating controls (control windows) • Processing of operating control commands received from HIF Control interface. The module verifies and interprets the received commands and forwards them to other software modules of the IntelliVue Patient Monitoring System display unit, Measurement Servers or Flexible Module Server • Sound generation (issues audible alarm signals and generates audible information signals, for example QRS and SpO_2 tones, operator audible feedback)
Interfaces	
LAN	The LAN interface implements the physical layer of IEEE 802.3. The LAN interface performs Manchester encoding/decoding, receive clock recovery, transmit pulse shaping, jabber, link integrity testing, reverse polarity detection/correction, electrical isolation, and ESD protection. Electronically separated interfaces are used for communication to the Measurement Servers or Flexible Module Server and to the network.
Centronics	The Centronics interface implements the standard signaling method for bi-directional parallel peripheral devices according to IEEE 1284-I. The interface is used as a parallel interface to a standard printer with electrical isolation and ESD protection.
Display Controller	The Display Controller Interface consists of a video controller chip, video RAM and the controlling software. The Display Controller interface processes the high level display commands (character and graphic generation, wave drawing) and translates them into pixels, which are written into the video RAM where the video controller chip generates the video synchronization signals and the pixel stream for the Color LCD Display.
HIF Control	The HIF (Human Interface Control) interface scans the Human Interface devices for operator controls (Touch Screen, Trim Knob, and PS/2 devices), formats the collected data and sends it to the display and Operating Interface.

Functional Block	Description
ECG-Out Marker-In	The ECG Out/Marker In interface receives the ECG waveform directly from the ECG/Resp Arrhythmia ST-Segment physiological algorithm via an RS-422 serial interface and converts the digital ECG signal to an analog ECG signal. In addition, the ECG Out controller receives from a connected device the marker information and forwards this data to the ECG/Resp Arrhythmia ST-Segment physiological algorithm. The converted analog signal is used to synchronize a connected device to the patient's ECG
RS-422	The serial link RS-422 interface communicates the ECG signal to the ECG Output/Marker In of the IntelliVue Patient Monitoring System display unit. The interface is a serial, differential, full-duplex link. The interface is ESD protected.
PS/2	The PS/2 interface supports the serial protocol of standard PS/2 devices (mouse). The PS/2 serial protocol is interpreted by the HIF Control interface.

3

Testing and Maintenance

Concepts

This chapter provides a checklist of the testing and maintenance procedures for the monitor, the MMS the Measurement Server Extensions and the FMS associated modules.

Preventive Maintenance refers specifically to the series of tests required to make sure the Instrument measurement results are accurate. The measurements requiring these reported tests are NBP and sidestream CO_2. The accuracy and performance procedures are designed to be completed when readings are in question or as specified.

Test Reporting

Authorized Philips personnel report test results back to Philips to add to the product development database. Hospital personnel, however, do not need to report results. This table shows you what to record on the service record after completing the tests in this chapter.

Test	**What to record**
Visual	V:P or V:F
Power On	PO:P or PO:F
P NIBP	PN:P/X1/X2/X3/X4 or PN:F/X1/X2/X3/X4
P CO_2	PCO2:P/X1/X2/X3/X4/X5/X6/X7/X8 or PCO2:F/X1/X2/X3/X4/X5/X6/X7/X8
Safety	S(1):P/x1/x2 or S(1):F/x1/x2 S(2): P/x1 or S(2): F/x1 S(3): P/x1 or S(3): F/x1

Where P = Pass, F = Fail and X/x are the measured values as defined in the tests described in this chapter.

Recommended Frequency

The testing checklist appears in the next section of this chapter. Perform the procedures as indicated in the suggested testing timetable. These timetable recommendations do not supersede local requirements.

Suggested Testing Timetable	**Frequency**
Preventive Maintenance Tests • NBP Calibration • Sidestream CO_2 Calibration • CO_2 pump / CO_2 scrubber replacement	Required • Once a year, or as specified by local laws. • Once a year or after 4,000 hours continuous use and following any instrument repairs or the replacement of any instrument parts. • Once every three years or after 15 000 operating hours
Performance and Safety Tests • Temperature Accuracy • ECG/Resp Performance • Invasive Pressure Performance • SpO_2 Performance • Mainstream CO_2 Performance • EEG Performance • C.O. Performance • BIS Performance • SvO2 Performance • tcGas Performance • VueLink Performance • Nurse Call Relay Performance* • ECG Sync Performance* *Only when in use as part of hospital protocols	Recommended: Once every two years, or if you suspect the measurement is incorrect
Safety Checks (in accordance with IEC 60601-1) • System Enclosure Leakage Current • Protective Earth • Patient Leakage Current	Recommended: Once every two years and after repairs where the power supply is replaced or the monitor has been damaged by impact.

Tests Recommended When Performing...

Installation

Service Event (When performing...	Test Blocks Required ...Complete these tests)
Installation of monitor with **no** display connected to the VGA output	Perform Visual and Power On Test Blocks
Installation of monitor with a display connected to the VGA output	Perform Visual, Power On and Safety (1) Test Blocks

Repair

Service Event (When performing...	Test Blocks Required ...Complete these tests)
Repairs of M3015A	Perform Power On and M3015A tests
Repairs where the monitor has been damaged by impact	Perform Power On and Safety (2) and (3) Test Blocks
Repairs where the power supply is replaced	Perform Safety (2) Test Block
All other IntelliVue Monitoring System repairs	Perform Power On Test Block

Preventive Maintenance

Perform preventive maintenance tests:

- NBP calibration
- Sidestream CO_2 calibration
- Pump and scrubber replacement.

Performance Verifications

Perform all safety, accuracy and performance test procedures listed in the following sections. If a particular measurement is in question, perform the measurement performance test only.

Upgrades

Service Event (When performing...	Test Blocks Required ...Complete these tests)
Hardware and software upgrades	Perform Power On Test Block unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade.

Tests

Some of the following testprocedures must be performed in service mode. To enter service mode select **Operating Modes** in the main menu. Then select **Service Mode** and enter the password.

If required, open the screen menu in the monitor info line at the top of the screen and select **Service** to access the service screen. This is required particularly for Anesthetic Gas Module testing procedures.

Visual Test

Inspect the system for obvious signs of damage. Also check external leads and accessories.

The expected test result is pass: the system has no obvious signs of damage.

Power On Test

1 Switch on the monitor and connect the MMS.

2 Observe whether the system boots up successfully and if an ECG wave appears on the screen.

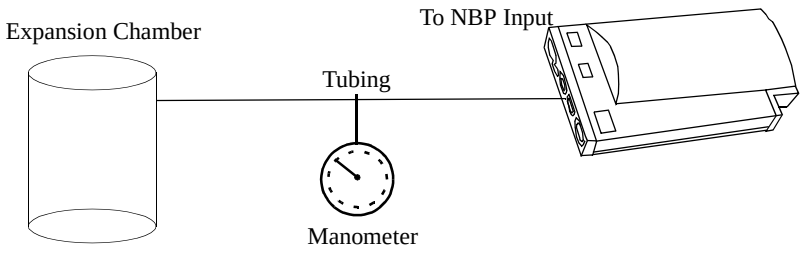
The expected test result is pass: the monitor boots up and displays an ECG wave. The wave might be a flat line if no simulator is attached.

NBP Tests

This section describes NBP test procedures.The monitor must be in service mode to perform these tests.

NBP Accuracy Test

This test checks the performance of the non-invasive blood pressure measurement. Connect the equipment as shown:



Tools required:

- Reference manometer (includes hand pump and valve), accuracy 0.2% of reading.
- Expansion chamber (volume 250 ml +/- 10%)
- Appropriate tubing.

In service mode, the systolic and diastolic readings indicate the noise of NBP channels 1 and 2 respectively. When static pressure is applied, the reading in NBP channel 1 should be below 50. The value in parentheses indicates the actual pressure applied to the system.

1 Connect the manometer and the pump with tubing to the NBP connector on the MMS and to the expansion chamber.

2 In service mode, select the **Setup NBP** menu.

3 Select **Close Valves: On**

4 Raise the pressure to 280 mmHg with the manometer pump.

5 Wait 10 seconds for the measurement to stabilize.

6 Compare the manometer values with the displayed values.

7 Document the value displayed by the monitor (x1).

8 If the difference between the manometer and displayed values is greater than 3 mmHg, calibrate the MMS. If not, proceed to the leakage test.

9 To calibrate the MMS, select **Close Valves off** then **Calibrate NBP** and wait for the instrument to pump up the expansion chamber.Wait a few seconds after pumping stops until **EnterPrVal** is highlighted and then move the cursor to the value shown on the manometer. If one of the following prompt messages appears during this step, check whether there is leakage in the setup:

– NBP unable to calibrate–cannot adjust pressure

– NBP unable to calibrate–unstable signal

10 Press **Confirm**.

If the INOP NBP Equipment Malfunction message occurs in monitoring mode, go back to service mode and repeat the calibration procedure.

NBP Leakage Test

The NBP leakage test checks the integrity of the system and of the valve. It is required once per year and when you repair the monitor or replace parts.

1 If you have calibrated, repeat steps 2 to 6 from the accuracy test procedure so that you have 280 mmHg pressure on the expansion chamber.

2 Watch the pressure value for 60 seconds.

3 Calculate and document the leakage test value (x2).
x2 = P1 - P2
where P1 is the pressure at the beginning of the leakage test and P2 is the pressure displayed after 60 seconds.
The leakage test value should be less than 6 mmHg.

NBP Linearity Test

1 Reduce the manometer pressure to 150 mmHg.

2 Wait 10 seconds for the measurement to stabilize.

3 After these 10 seconds, compare the manometer value with the displayed value.

4 Document the value displayed by the monitor (x3)

5 If the difference is greater than 3 mmHg, calibrate the MMS (see steps 9 to 10 in the accuracy test procedure).

Valve Test

1 Raise the pressure again to 280 mmHg.

2 Select **`Close valves: Off`**.

3 Wait five seconds and then document the value displayed. The value should be less than 10 mmHg.

4 Document the value displayed by the monitor (x4).

Test	Expected test results
Accuracy test	x1 = value displayed by monitor Difference ≤ 3mmHg
Leakage test	x2 = leakage test value x2 < 6 mmHg
Linearity test	x3 = value displayed by monitor Difference ≤ 3mmHg
Valve Test	x4 = value < 10 mmHg

Sidestream CO_2 Performance Test

Allow five seconds between individual service procedures to ensure stable equipment conditions. When certain monitor procedures are running, service procedures are not possible and trying to start them will result in a message **`Service Operation Failed`** in the monitor's status line. Wait until the monitor completes the current operation, then restart the service procedure.

This test checks the performance of the CO_2 measurement for the sidestream extension. The CO_2 performance test is required once per year and when the instrument is repaired or when parts are replaced.

This test uses calibration equipment that you can order (see the *Parts* section for the part number). The procedure is summarized in the following steps. Refer to the documentation accompanying the equipment for detailed instructions.

Tools Required:

- Standard tools, such as screwdriver, tweezers
- Electronic flowmeter, M1026-60144.
- Gas calibration equipment:
- Cal 1 gas 15210-64010 (5% CO_2)
- Cal 2 gas 15210-64020 (10% CO_2)
- Cal gas flow regulator M2267A
- Cal tube 13907A

You also need a local barometric pressure rating received from a reliable local source (airport, regional weather station or hospital weather station) which is located at the same altitude as the hospital.

The CO_2 calibration for the sidestream extension consists of the following steps:

- Barometric pressure check and calibration, if required.

- Leakage check
- Pump check
- Flow check and calibration, if required.
- Noise check
- CO_2 Cal check and calibration, if required.
- CO_2 Cal verification using 2nd cal gas

Perform all checks in the same session.

Barometric Pressure Check and Calibration

Check the barometric pressure value in the sidestream CO_2 extension as follows:

1 Go into service mode and select **Setup CO_2** menu.

2 Connect a FilterLine to the sidestream CO_2 input. This activates the pump in the sidestream CO_2 Extension.

3 The status line at the bottom of the screen displays “CO2 pressure reading (ambient/cell) xxx/yyy” where xxx is the ambient pressure and yyy is the measured cell pressure. Check whether the ambient pressure value (x1) matches (within the acceptable tolerance of ±12mm Hg) the reference value you have received. If so, proceed to the leakage check. If the value is not correct, calibrate as follows.

   a. Select **CO_2** then select **Barom.Press** to activate a table of values.

   b. Select the value in the table which matches the reference value received from a reliable local source (airport, regional weather station or hospital weather station). (The values are displayed with a resolution of 2 mmHg up to 500 mmHg and a resolution of 1 mmHg from 500 mmHg to 825 mmHg.) Note: the selected value must be within ±10% of the current measured ambient pressure, otherwise an error message will occur at restarting the monitor.

   c. Confirm the barometric pressure setting.

   d. Check that the ambient pressure displayed in the status line at the bottom of the screen is the same as the value which you selected from the list in step b.

Leakage Check

The leakage check consists of checking the tubing between:

- the pump outlet and the measurement server extension outlet and
- the pump inlet and FilterLine inlet.

Check the user’s guide of the flowmeter for details on how to make a correct flow reading.

Part 1

1 Go into service mode and select **Setup CO_2** menu.

2 Connect a FilterLine to the sidestream CO_2 input to start the pump running.

3 Check the ambient pressure and the cell pressure shown in the monitor’s status line. The cell pressure should be approximately 20 mmHg lower than ambient pressure.

4 Connect the flowmeter outlet to the FilterLine inlet using a flexible connecting tube.

5 Block the measurement server extension outlet using your fingertip and observe the flowmeter display. The value on the flowmeter (x2) should decrease to between 0 and 4 ml/min, accompanied by an audible increase in pump noise. If the value is within the tolerance limits, continue with part 2 of the leakage check.

6 If the value is outside the tolerance limits, there is a leakage between the pump outlet and the measurement server extension gas outlet.

7 Open the measurement server extension and check the tubing connections at the pump outlet and the extension gas outlet. If the connections are good, then there is a leakage in the tubing and you must exchange the measurement server extension.

Part 2

1 Disconnect the flowmeter from the Part 1 setup and connect the flowmeter inlet to the M3015A gas outlet.

2 Leave the Filterline connected to the M3015A inlet.

3 Block the inlet of the FilterLine using your fingertip and observe the flowmeter display. The value on the flowmeter (x3) should decrease to between 0 and 4 ml/min, accompanied by an audible increase in pump noise. Do not block the inlet for longer than 25 seconds as this will lead to an "Occlusion" INOP. If the value is within the tolerance limits, there are no leakages and the leakage check is completed; proceed to the pump check.

4 If the value is not within the tolerance limits, there is a leakage between the FilterLine inlet and the pump inlet.

5 Check the FilterLine connections and open the M3015A to check the tubing connections at the pump inlet and the M3015A gas inlet. If the connections are good, try replacing the FilterLine and repeating the leakage check. If the situation remains, there is a leakage in the tubing and the M3015A must be exchanged.

Pump Check

1 Connect the flowmeter inlet to the M3015A gas outlet.

2 Connect the FilterLine to the M3015A inlet.

3 Block the inlet of the FilterLine using your fingertip and observe the cell pressure on the M3046A display. The cell pressure (x4) should be more than 120 mmHg below the ambient pressure shown. If the pressure difference is less than 120 mmHg, the pump is not strong enough and you should replace it, irrespective of the Pump OpTime.

Flow Rate Check and Calibration

Check the flow rate in the sidestream CO_2 extension as follows:

1 Connect the flowmeter to the CO_2 FilterLine.

2 Check on the flowmeter the flow that the sidestream CO_2 extension pump draws (x5). It should be 50 ml/min ± 7.5 ml/min. If the value is within tolerance, proceed to the CO_2 Gas calibration check. If the value is not within tolerance, calibrate as follows.

3 Adjust the flow in the instrument by selecting **`Increase Flow`** or **`Decrease Flow`** until it is as close as possible to 50 ml per minute as indicated on the flowmeter gauge.

4 When you are satisfied that the flow is set as close as possible to 50 ml per minute, select **Store Flow** and confirm the setting. If you do not store the adjusted flow within 60 seconds of the adjustment, the old flow setting is restored.

5 If you cannot adjust the flow to within tolerance, replace the pump. If you still cannot make the flow adjustment, this indicates a fault in the measurement extension, which must be replaced.

Noise Check

1 With the monitor in service mode, select **Setup CO_2** menu.

2 Disconnect the flowmeter and connect the 5% calibration gas and flow regulator in its place.

3 Open the valve to apply the 5% calibration gas and wait until the value is stable.

4 Check the noise index (x6) displayed next to the CO_2 value on the display (this indicates the level of noise on the CO_2 wave). If the value exceeds 3 mmHg, replace the measurement extension.

CO_2 Gas Measurement Calibration Check

After switching the measurement extension on, wait at least 20 minutes before checking the calibration. Check the calibration of the CO_2 gas measurement as follows:

1 Check that the 5% calibration gas and flow regulator are connected.

2 Calculate the expected measurement value in mmHg as follows:

0.05 x (ambient pressure) = value mmHg
for example 0.05 x 736 = 36.8 mmHg (with an ambient pressure of 736 mmHg)

3 Open the valve on the flow regulator to allow 5% CO_2 gas to flow into the extension. Allow the value to stabilize.

4 Check that the value on the instrument (measurement value on the main screen, x7)) matches the calculated mmHg value ± 2.6 mmHg. If the value is outside the tolerance, calibrate as described in step 9 in this procedure onwards.

5 Disconnect the 5% calibration gas and connect the 10% calibration gas.

6 Calculate the expected measurement value and tolerance in mmHg as follows:

0.1 x (ambient pressure) = value mmHg
±0.07 x (value mmHg) = tolerance

for example 0.1 x 737 mmHg = 73.7 mmHg (with an ambient pressure of 737 mmHg)
±0.07 x 73.7 mmHg = ±5.16 mmHg tolerance

7 Open the valve on the flow regulator to allow 10% CO_2 gas to flow into the extension. Allow the value to stabilize.

8 Check that the value on the instrument (x8) matches the calculated mmHg value within the calculated tolerance. If so, the measurement extension is correctly calibrated. If the value is outside the tolerance, calibrate as follows.

9 If not already connected, connect the 5% calibration gas.

10 Select **Cal. CO_2**.

11 Select the value for the calibration gas. (The default value is 5.0%.)

12 Open the valve on the calibration gas to allow CO_2 gas to flow into the extension. Allow the value to stabilize before the start of the calibration. Leave the valve open until the instrument gives a prompt that gas can be removed.

13 The extension calibrates and prompts when calibration is successful.

Calibration Verification

1 Reopen the 5% gas valve and allow the value to stabilize.

2 Check that the value displayed on the monitor is correct within the tolerance (see step 2 above).

3 Disconnect the 5% calibration gas and connect the 10% calibration gas.

4 Open the valve on the flow regulator to allow 10% CO_2 gas to flow into the extension. Allow the value to stabilize.

5 Check that the value displayed on the monitor is correct within the tolerance (see step 6 above).

If one or both values are not within tolerances, you must exchange the measurement server extension.

Reset Time Counters

You must check the time counters on the sidestream CO_2 extension before calibrating the instrument. As well, when parts are replaced, the appropriate counters must be reset to zero.

The counters for CO_2 pump, IR Src and Last Cal are displayed in the status line. The values are updated when entering the **`Setup CO2`** menu.

Observe the following guidelines:

- When calibrating the CO_2 extension, if no parts have been replaced, check the displayed values of **`Reset PumpOpTime`** and **`Reset IRSourceTime`** selections to make sure that they are within suggested guidelines for use (15, 000 hours of continuous use). If the counter time is greater than 15, 000 hours, replace the appropriate part. See *Repair and Disassembly* for details.
- When calibrating the CO_2 extension, if parts have been replaced, reset the appropriate values using the **`Reset PumpOpTime`** and **`Reset IRSourceTime`** selections. See *Repair and Disassembly* for details.

Resetting the PumpOpTime generates the INOP: "CO_2 OCCLUSION". To clear this INOP you must perform a flow check and store the flow in service mode (select **`Store Flow`**).

Table 1 Documenting CO_2 Test Results

Test	Expected Test Results
Barometric Pressure Check	x1 = difference between the reference pressure and the measured ambient pressure displayed on the monitor (x1<12 mmHg)
Leakage Check parts 1 and 2	x2 = value of part 1 leakage check on flowmeter (x2< 4.0 ml/min) x3 = value of part 2 leakage check on flowmeter (x3< 4.0 ml/min)

Table 1 Documenting CO_2 Test Results

Test	Expected Test Results
Pump Check	x4 = difference in pressure between cell pressure and ambient pressure displayed on the monitor during occlusion (x4 >120 mmHg)
Flow Check	x5 = difference between measured value and 50.0 ml/min (x5<7.5 ml/min)
Noise Check	x6 = noise index displayed on monitor (x6<3.0)
CO_2 Gas Calibration Check	x7 = difference between measured CO_2 value and calculated value, based on 5% CO_2 cal. gas. (x7 < 2.6 mmHg)
CO_2 Cal Verification	x8 = difference between measured CO_2 value and calculated value, based on 10% CO_2 cal. gas. (x8 < ± {0.07 x value calculated})

Temperature Accuracy

This test checks the performance of the temperature measurement.

Tools required: Patient simulator (with 0.1°C or 0.2°F).

1 Connect the patient simulator to the temperature connector on the MMS or measurement server extension.

2 Configure the patient simulator to 40 °C or 100 °F.

3 The value should be 40 °C ± 0.2 °C or 100 °F ± 0.4 °F.

ECG/Resp Performance Test

This test checks the performance of the ECG and respiration measurements.

Tools required: Patient simulator.

ECG Performance

1 Connect the patient simulator to the ECG/Resp connector on the measurement server.

2 Configure the patient simulator as follows:

- ECG sinus rhythm.
- HR = 100 bpm.

3 Check the displayed ECG wave and HR value against the simulator configuration.

4 The value should be 100bpm +/- 2bpm.

Respiration Performance

1 Change the Patient Simulator configuration to:

- Base impedance line 1500 Ohm.
- Delta impedance 0.5 Ohm.
- Respiration rate 40 rpm.

2 The value should be 40 rpm +/- 2 rpm.

Invasive Pressure Performance Test

This test checks the performance of the invasive pressure measurement.

Tools required: Patient simulator.

1 Connect the patient simulator to the pressure connector on the MMS or the measurement server extension.

2 Set the patient simulator to 0 pressure.

3 Make a zero calibration.

4 Configure the patient simulator as P(static) = 200 mmHg.

5 Wait for the display.

6 The value should be 200 mmHg ± 5 mmHg. If the value is outside these tolerances, calibrate the MMS or measurement server extension. If the MMS was calibrated with a dedicated reusable catheter, check the calibration together with this catheter.

SpO_2 Performance Test

This test checks the performance of the SpO_2 measurement.

Tools required: none

1 Connect an adult SpO_2 transducer to the SpO_2 connector on the MMS.

2 Measure the SpO_2 value on your finger (this assumes that you are healthy).

3 The value should be between 95% and 100%.

Cardiac Output Performance Test

These tests check the performance of the cardiac output measurement.

1 Connect the patient simulator to the C.O. module using the patient cable.

2 Configure the patient simulator as follows:
Injection temperature: 2 °C
Computation Const: 0.542
(Edward's Catheter)
Flow: 5 l/min

3 Check displayed value against the simulator configuration.

4 Expected test result: C.O. = 5 +/– 1 l/min.

Service Tool Procedure, Version 1

This procedure applies for Service Tool M1012-61601 and/or C.O. modules without option C10.

1 In monitoring mode, connect the C.O. interface cable to the module.

2 Connect one side of the service tool to the injectate receptacle of C.O. interface cable and the other side to catheter cable receptacle.

3 Enter the **`C.O. Procedure`** window and check the results. The expected test result is:

– Tblood = 37.0°C +/- 0.1°C

Service Tool Procedure, Version 2

This procedure applies only for Service Tool M1012-61601 in combination with C.O. modules with option C10.

1 In monitoring mode, connect the C.O. interface cable to the module.

2 Connect one side of the service tool to the injectate receptacle of the C.O. interface cable and the other side to the catheter cable receptacle.

3 Enter **`Setup C.O`**. menu and check results for:
- Method of measurement
- Catheter constant
- Tblood

4 Enter **`C.O. Procedure`** window and check results. The expected results are
- Transpulmonary 341
- Tblood = 37.0°C +/- 0.1°C

BIS Performance Test

These tests check the performance of the BIS measurement.

PIC/DSC Test

1 In monitoring mode connect the sensor simulator (for maximum usage please refer to the documentation delivered with the sensor simulator) to the patient interface cable.

2 Enter the BIS menu and select **`Open Window`**.

3 Start impedance check by pressing **`StartCyclicCheck`**. Check the displayed results. Expected results are:
- Electrode 1 (+): 4-6 kΩ
- Electrode 2 (Ref): 8-12 kΩ
- Electrode 3 (1-): 1-3 kΩ
- Electrode 4 (2-): 1-3 kΩ

Nurse Call Relay Performance Test

The nurse call relay performance test can be performed either at the phone jack type connector (this only tests one relay) or at the multi-port nurse call connector (to test all three relays).

Phone Jack Type Connector Test

This test checks the operation of the Nurse Call Relay. The Nurse Call Relay test is recommended for customer sites where the nurse call is in use. The Nurse Call relay functions as follows:

- Standard Operation—Relay open.
- Alarm Condition—Relay closed.

Tools required: Ohmmeter.

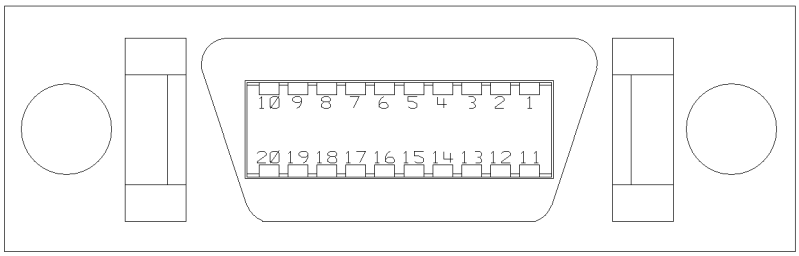
1 Plug a phono connector into the Nurse Call Relay connector.

2 Connect the ohmmeter.

3 If no alarm occurs, the relay contacts are open. When an alarm occurs, the relay contacts close.

Multi-Port Nurse Call Connector Test

This test checks the operation of the Flexible Nurse Call Relay. The Nurse Call Relay test is recommended for customer sites where the nurse call is in use. The following diagram and table show the pins and relay identifiers of the connector:



Front View

Pin	Cable Color Coding	Relay
1	black	R2-closure
2	brown	R2-middle
3	red	R2-opener
4	orange	R3-closure
5	yellow	R3-middle
6	green	R3-opener
7	blue	n/a
8	purple	n/a
9	gray	n/a
10	white	n/a
11	pink	R1-closure
12	light green	R1-middle
13	black/white	R1-opener
14	brown/white	n/a
15	red/white	n/a
16	orange/white	n/a
17	blue/white	R_failure_closure
18	purple/white	R_failure_middle
19	green/white	R_failure_opener
20	red/black	n/a

The Nurse Call relay functions as follows:

- During standard operation R1,R2,R3 _opener are closed; R1,R2,R3_closure are open.
- During alarm condition—R1,R2,R3_opener are closed; R1,R2,R3_closure are open.

Tools required: Ohmmeter.

1 Plug an M8087-61001 cable into the Nurse Call Relay connector.

2 Connect the ohmmeter and measure the pins as indicated in the diagram and table.

3 The relay contacts should behave as described above. The behavior may vary depending on configuration choices. See the Configuration Guide for details on Alarm Relay settings.

ECG Sync Performance Test

This test checks the performance of ECG synchronization between the monitor and a defibrillator. It only needs to be performed when this feature is in use as a protocol at the customer site.

Tools required:

- Defibrillator with ECG Sync and Marker Output.
- Patient simulator.

1 Connect the patient simulator to the ECG connector on the Measurement server and the defibrillator to the ECG Sync Output on the monitoring.

2 Set the patient simulator to the following configuration:
   – HR = 100 bpm.
   – ECG sinus rhythm.

3 Switch the defibrillator to simulation mode.

4 Check that the marker pulse is displayed before the T-wave begins.

VueLink Tests using VueLink Test Module

Use the VueLink plug-in test module (M1186-60510) to test M1032A VueLink modules.

Test Procedure

You must preselect the test module to ON in Configuration Mode. Therefore, the test module must be one of the devices made available for selection during configuration of the VueLink module.

Carry out the test itself in monitoring mode. For information concerning the configuration of VueLink modules see the M1032A VueLink Module Handbook.

1 Plug the VueLink module into the FMS.

2 Press the Setup key on the front of the VueLink module.

3 In the **Setup VueLink** menu select **Device**, then select **Test Module**.

4 Select **Confirm** to store the selection and wait for the message “Switched to new device”.

5 Plug in the test module.

6 Connect the modules by plugging one end of the cable (part number M1032-61661) into the connector on the front of the VueLink Module, and the other end into the connector on the front of the Test Module.

7 Select the wave segment on the screen, where you want the waves to appear. In the wave menu, select **Change Wave**, then select **WAVE**.

8 Select the **VueLink** SmartKey, then select the **TEST Plug-In** pop-up key

The test module acts in the same way as an external device would, and sends signals to the VueLink module in both analog and digital form. The computer module checks these signals for validity, and then displays “passed” or “failed” on the screen.

The wave segment displays two waveforms, a triangular one and a rectangular one. These are displayed alternately and for a period of ten seconds each. The expected curve type is indicated below the wave.

There are two pairs of gridlines that indicate the permitted range for the max/min values of these waves. If all the data received by the test module is correct, the waves will lie within the specified ranges. If either limit of either wave falls outside the respective gridlines, then the module being tested is faulty regardless of the passed/failed messages.

When the test is complete:

1 Disconnect the cable that joins the test module to the VueLink module.

2 In configuration mode, ensure that the test module is not selected, and the preselected devices are the same ones as before the test. Also, verify the settings for these devices.

3 Return to monitoring mode.

4 Press the Setup key on the front of the VueLink module and select the required device by selecting **`Device`** in the **`Setup VueLink`** menu.

NOTE It is important to ensure that the preselected device drivers are configured exactly the same as they were before the test, including their default settings.

Safety Testing

You are recommended to file the results of safety tests. This may help to identify a problem early particularly if the test results deteriorate over a period of time.

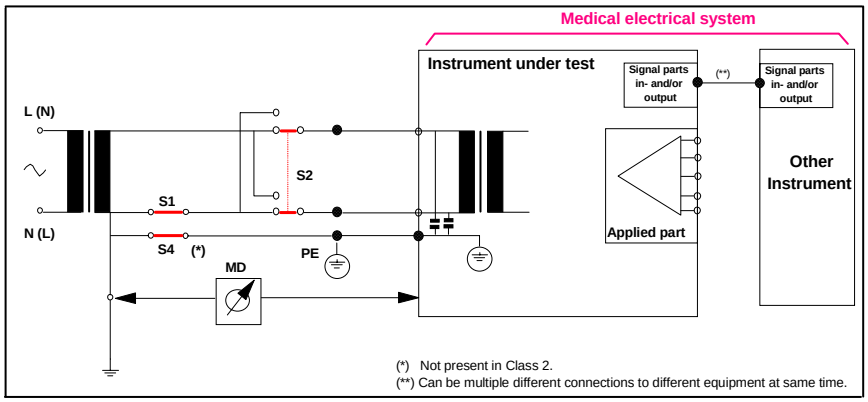
Warnings, Cautions, and Safety Precautions

- These tests are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator.
- You can perform all tests using commercially available ***Safety Analyzer*** test equipment. You can perform basic measurements with widely available multifunction instruments such as the HP 3469A multimeter or equivalent.
- The consistent use of a ***Safety Analyzer*** as a routine step in closing a repair or upgrade is emphasized as a mandatory step to maintain approval agency status. You can also use the ***Safety Analyzer*** as a troubleshooting tool to detect abnormalities of line voltage and grounding plus total current loads.
- For Europe and Asia/Pacific according to:
  IEC60601-1:1988 + A1:1991 + A2:1995 = EN60601-1:1990 +A1:1991 + A2:1995
  For USA according to:
  UL2601-1
- Additional tests may be required according to local regulations.
- Normally, a ***Safety Analyzer*** is used to perform these procedures. Popular testers include the DEMPSEY 232D, or for use in Europe, testers like the Rigel, Metron or Gerb. Follow the instructions of the Instrument manufacturer. If the Dempsey is used for an extended length of time, it could be damaged by the high amp current draw of the system.

Safety Test Procedures

Use the test procedures outlined here **only** for verifying safe installation or service of the product. The setups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent. These tests are not a substitute for local safety testing where it is required for an installation or a service event. If using the Metron Safety tester, perform the tests in accordance with your local regulations, for example in Europe use IEC60601-1/IEC60601-1-1 and in the US use UL2601-1. The Metron Report should print results with the names listed below, together with other data.

S(1) Part 1: System Enclosure Leakage Current - NC (normal condition)



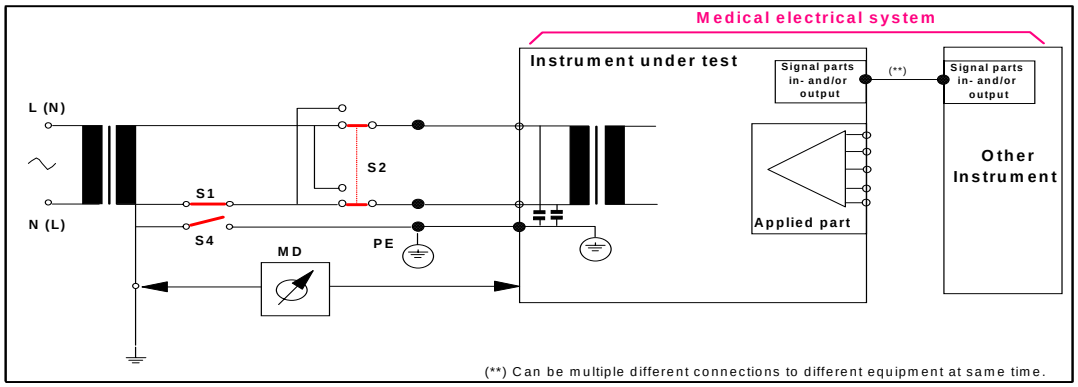
Expected test results:

- Normal condition maximum leakage current x1 ≤ 100µA

This measures leakage current of exposed metal parts of Instrument under Test (IUT) and between parts of the system within the **patient environment**; normal and reversed polarity using S2.

Safety test according IEC 60601-1 / UL2601-1

S(1) Part 2: System Enclosure Leakage current - Single Fault (open earth)



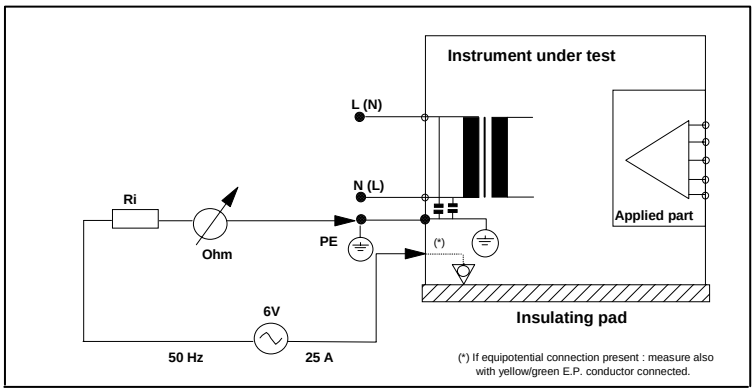
Expected test results:

- Single Fault maximum leakage current x2 ≤ 500µA (IEC 60601-1)

≤ 300µA (UL2601-1)

This measures leakage current of exposed metal parts of Instrument under Test (IUT) with Protective Earth (PE) open circuit (S4 = open) and between parts of the system within the **patient environment**; normal and reversed polarity using S2.

S(2) Protective Earth Continuity

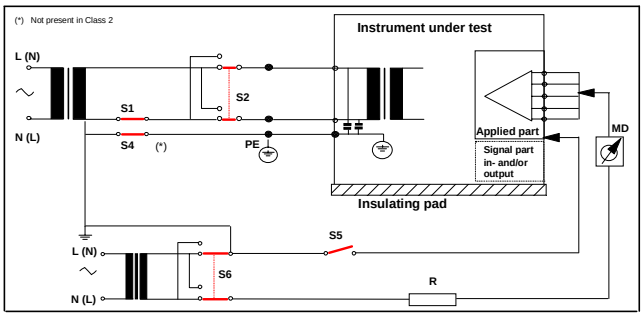


Expected test results:

- With mains cable, maximum impedance x = 100 mOhms (IEC 60601-1 and UL2601-1)

This measures impedance of Protective Earth (PE) terminal to all exposed metal parts of Instrument under Test (IUT), which are for safety reasons connected to the Protective Earth (PE). Test current 25 Amp applied for 5 to 10 seconds.

S(3) Patient Leakage current - Single Fault Condition (S.F.C.) mains on applied part



Expected test results:

- Maximum leakage current, x = 50µA @ 250V (IEC60601-1 and UL2601-1)

Measures patient leakage current from applied Part to earth caused by external main voltage on applied Part with switch S5 open and closed. Each polarity combination possible is tested using S2 and S6. This test is applicable for every measurement input .

Touchscreen Calibration

To access the touchscreen calibration screen:

1 Enter service mode

2 Select **Main Setup**

3 Select **Hardware**

4 Select **Touch Calibration**

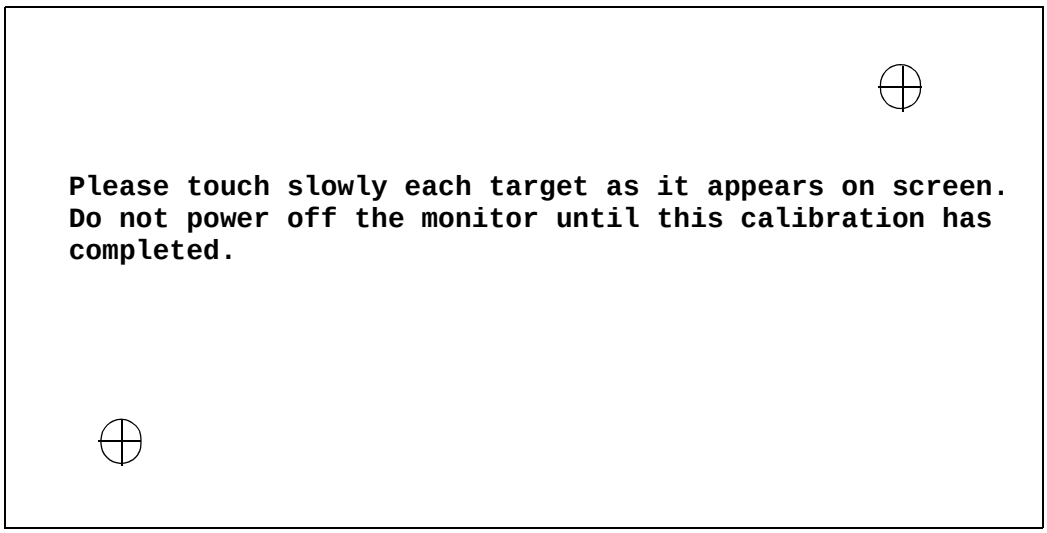


Figure 5 Touchscreen Calibration Screen

Make sure you complete the calibration procedure without powering off the monitor mid-way. If the monitor is powered off after the first point is touched, the touch panel will be deactivated until the touch calibration is performed again.

If the touchscreen is accidentally mis-calibrated by selecting the wrong spot, you must use another input device to re-enter calibration mode. If you have the support tool, you can select **Reset Touch Calibration to Default** and it will create a rough calibration which will allow you to access the calibration menu again via the touchscreen.

4

Troubleshooting

Introduction

This section explains how to troubleshoot the monitor if problems arise. Links to tables that list possible monitor difficulties are supplied, along with probable causes, and recommended actions to correct the difficulty.

How To Use This Section

Use this section in conjunction with the sections *Testing and Maintenance* and *Parts*. To remove and replace a part you suspect is defective, follow the instructions in the section *Repair and Disassembly*. The *Theory of Operation* section offers information on how the monitor functions.

Who Should Perform Repairs

Only qualified service personnel should open the monitor housing, remove and replace components, or make adjustments. If your medical facility does not have qualified service personnel, contact Philips' Response Center or your local Philips representative.

WARNING High Voltage - Voltages dangerous to life are present in the instrument when it is connected to the mains power supply. Do not perform any disassembly procedures (other than server and extension removal) with power applied to the instrument. Failure to adhere to this warning could cause serious injury or death.

Replacement Level Supported

The replacement level supported for this product is to the printed circuit board (PCB) and major subassembly level. Once you isolate a suspected PCB, follow the procedures in the *Repair and Disassembly* section, to replace the PCB with a known good PCB. Check to see if the symptom disappears and that the monitor passes all performance tests. If the symptom persists, swap back the replacement PCB with the suspected malfunctioning PCB (the original PCB that was installed when you started troubleshooting) and continue troubleshooting as directed in this section.

Software Revision Check

Some troubleshooting tasks may require that you identify the Software Revision of your monitor. You can find the software revision along with other information, such as the system serial number, in the monitor revision screen.To access the monitor revision screen:

1 Enter the Main Setup menu and select **Revision**

2 Select the pop-up key **Software**

NOTE The system serial number can also be found on the lower right corner on the front of the monitor.

Obtaining Replacement Parts

See *Parts* section for details on part replacements.

Troubleshooting Guide

Problems with the monitor are separated into the categories indicated in the following sections and tables. Check for obvious problems first. If further troubleshooting instructions are required refer to the Troubleshooting Tables.

Taking the recommended actions discussed in this section will correct the majority of problems you may encounter. However, problems not covered here can be resolved by calling Philips Response Center or your local representative.

Checks for Obvious Problems

When first troubleshooting the instrument, check for obvious problems by answering basic questions such as the following:

1 Is the power switch turned on?

2 Is the AC power cord connected to the instrument and plugged into an AC outlet?

3 Are the MMS and, if present, the measurement server extension inserted correctly?

4 Are the cables connected properly to the FMS?

5 Are the parameter modules plugged into the FMS correctly?

Checks Before Opening the Instrument

You can isolate many problems by observing indicators on the instrument before it is necessary to open the instrument.

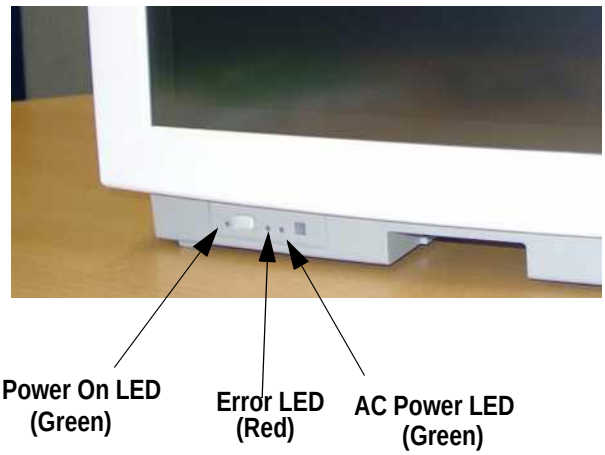
NOTE It takes several seconds for the AC Power LED to switch on / off after the mains power cord has been connected / disconnected.

Checks with the Instrument switched Off

- AC connected:
  - AC Power LED is on (green).
- No AC connected:
  - All LEDs are off.

Checks with the Instrument Switched On, AC connected

When the monitor is first switched on, all the front-panel LEDs and keys light up momentarily. The location of the front-panel LEDs is shown in the following photograph:



Initial Instrument Boot Phase

The following tables describe the regular initial boot phase of the monitor and its components. If the boot phase does not proceed as described below go to Boot Phase Failures for Troubleshooting information.

Monitor Boot Phase:

For these steps it is assumed that the Monitor is powered correctly and the +5V System Board supply voltage is okay. This is indicated by the green Power On LED.

Time (sec.) after Power On	Event
0	When the Power On/Off button is pressed, the green Power On LED and the red error LED switch on immediately.
1	The alarm LEDs are switched on with low intensity. Colors: Left LED:cyan; Middle LED:red; Alarm Suspend LED (right): red
3	Red Error LED is switched off.
4	Boot Screen with the Philips Logo appears on the display. Test Sound is issued.
5	All Alarm LEDs are switched off.
6	Alarm LEDs are tested in the following sequence: Cyan on-off (left LED only) Yellow on-off (left & middle LED) red on-off (all LEDs)
8	Fixed screen elements (for example smart keys, alarm fields) appear on the screen. Boot Screen with the Philips Logo disappears
15-30	First measurement information appears on the screen,user input devices (for example Mouse, Touch, Speed Point) are functional

Flexible Module Server Boot Phase

For these steps it is assumed that the Flexible Module Server is connected via SRL-cable to the monitor

Time (sec.) after Monitor Power On	Event
0	Red Error LED switches on immediately
1	Green “Ready” LED switches on
3	Red Error LED is switched off
5	Module Power is switched on
5-8	Module Status LEDs blink once or twice (Module dependent)

Troubleshooting Tables

The following tables list troubleshooting activities sorted according to symptoms. Click on the links below to view a particular table.

How to use the Troubleshooting tables

The possible causes of failure and the remedies listed in the troubleshooting tables should be checked and performed in the order they appear in the tables. Always move on to the next symptom until the problem is solved.

Boot Phase Failures

Integrated Display is blank

Integrated Touch Display not functioning

External Display is blank

External Touch Display not functioning

Remote Alarm Device

Remote Extension Device

Speed Point

Keyboard/Mouse not functioning

Network related problems

Wireless Network

Multi-Measurement Server

MSL-related problems

Alarm Lamps

Alarm Tones

Individual Parameter INOPS

Flexible Module Server

Integrated Module Slots

Printer

MIB / RS232

Flexible Nurse Call Relay

Boot Phase Failures

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
AC LED does not light up	AC Connection not ok	Check that the AC-Mains are powered and the power cord is ok and connected
	LED defective	Try to switch on the monitor. If it operates normally , the LED is defective => exchange Power Switch board.
	Power Switch board not connected to the main board	Check if power switch board is connected correctly to the Main Board
	Power supply defective	Remove power supply and check if output voltage is within the specifications (47V - 49V). Measure on multi-colored wired connection between red and black wires Exchange power supply if defective
	Integrated Module Slot defective	Disconnect Integrated Module Slot Connector and check again
	Flat Panel adapter Board defective	Disconnect cable of the Flat Panel Adapter Board and check again
	Video Board defective	Remove Video Board and check again
	Main Board defective	Exchange Main Board
Green Power On LED **and** Red Error LED remain off after pressing power on button:	Remote Devices	Disconnect all connections to the remote devices and try to switch on the monitor again
	Power Switch Micro Controller hung	Unplug AC Mains and replug after 10 seconds. Try to switch on the monitor again.
	Power switch board not connected to the main board	Check if power switch board is connected correctly to the main board.
	Power Switch Board defective	Exchange Power Switch BOard and try to switch the monitor on again.
	I/O Board defective	Remove all I/O boards and try to switch the monitor on again
	Touch controller defective Flat Panel Adapter Board defective ECG-Out Board defective SRL-2 Board defective	Disconnect all cables accessible at the bottomof the monitor (except Power Switch cable): - touch - video - ECG-Out - SRL-2 then try to switch the monitor on again
	Measurement Server Mount defective	Disconnect Measurement Server Mount and try again
	Integrated Module Slot defective	Disconnect Integrated Module Slot and try again
	Video Board defective	Remove video board and try again
	Main Board defective	Exchange main board. Add boards in reverse order and try again with each board.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Green On/ Standby LED **or** Red Error LED remain off after pressing Power on button:	Power Switch Board not connected to the main board	check if power switch board is connected correctly to the main board
	Power Switch board defective	exchange Power switch board
	Main board defective	exchange main board
Red Error LED stays on continuously	External connected device defective	disconnect all external cables (except AC) and switch the monitor on again
	I/O Board defective	Remove all I/O boards and switch the monitor on again.
	Touch controller defective Flat Panel Adapter board defective ECG-Out board defective SRL-2 board defective	disconnect all cables accessible at the bottom of the monitor (except Power Switch cable): - touch - video - ECG-Out - SRL-2
	Measurement Server Mount defective	Disconnect Measurement Server Mount and switch on again
	Integrated Module Slot defective	Disconnect integrated module slot and switch on again
	Video Board defective	Remove video board and switch on again
	Main board defective	Exchange Main board
Red Error LED blinks (indicating cyclic reboots)	Hardware Failure	connect Support Tool directly to monitor with crossover cable and start “search for defective devices” If no device is detected, proceed as described above in section “Red error LED stays on continuously”
	Software Fault	If the Support Tool can detect the device and it indicates the Operating Mode is ‘Boot’, download and store the status log. Reload software and re-clone the monitor. If this fixes the problem e-mail the status log to your local response center
	Hardware Failure	If this does not rectify the problem follow instructions under “Red Error LED stays on continuously”.
Alarm LEDs remain off:	Alarm LED board is defective	Check for INOPS and follow instructions Exchange Alarm LED board
	Main board defective	Exchange Main board
No Test Sound issued	Speaker defective	check for INOPs and follow instructions exchange speaker
	Main board defective	exchange main board

Integrated Display is blank

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Integrated display is blank or brightness is reduced (The information listed in this table is only valid if the boot phase has completed without error. See Boot Phase Failures table for a description of the Boot phase.)	Display brightness is reduced when room temperature, or instruments placed near patient monitor, causes the monitor display to overheat.	Instrument should be placed in an environment that does not exceed 40 degrees C or below 5 degrees C.
		If you have an external XGA display, connect it to the video port. If the external display works, you can eliminate the Video I/F board and the main board as the cause of failure.
	Flat Panel Adapter cable not connected	Check cable connection of Flat Panel Adapter Board to Video Board
	Backlight Inverter Cable not connected	Check cable connection of Flat Panel AdapterBoard to Backlight Inverter Board
	Backlight tubes defective	Replace backlight tubes
	Backlight Inverter board defective	If backlight tubes have already been replaced, replace backlight inverter board.
	Panel Adapter board defective	Replace panel adapter board
	LCD Flat panel defective	Replace LCD Flat panel
	Video board defective	Replace video board
	Main board defective	Replace main board

Integrated Touch Display not functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Touch Screen not functioning	Touch controller cable not connected	Check connection from the touch controller board to the main board
	Touch panel cable not connected	Check connection from touch controller board to touch panel
	Touch controller board defective	Replace touch controller board **Note:** Linearization data must be loaded and recalibrated after replacing the touch controller board
	Touch Sensor defective	Replace Touch Sensor
	Main board defective	Replace main board
Touch Position invalid	Touch not calibrated	Perform touch calibration: 1. Enter the Main Setup Menu 2. Select Monitor 3. Select Hardware 4. Select Touch Driver Settings 5. Select Calibrate

External Display is blank

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
External Display is blank		If integrated display is also blank proceed as described under “Integrated Display is blank”
	Video cable to external display not connected	Check video cable connection to external display
	External display has no power	Check electricity supply of external display
	External display is defective	Check external display and video cable on another monitor or PC
	Video board defective	Replace video baord
	Main board defective	Replace main board

External Touch Display not functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Touch Screen not functioning	External Tocuh cable not connected	Check cable connection from external touch to MIB board
	External Touch driver configuration	Check RS232/MIB configuration: 1. Enter Main Setup menu 2. Select Monitor 3. Select Hardware 4. Reconfigure RS232/MIB drivers 5. if problem persists, proceed to the next step
	MIB Board defective	Replace MIB board
	External touch defective	Replace external touch
	Main board defective	Replace Main board
Touch position invalid	Touch not calibrated	Perform touch calibration: 1. Enter Main Setup menu 2. Select Monitor 3. Select Hardware 4. Select Touch Driver 5. Select Calibrate

General Monitor INOP Messages

INOP Message	Possible Causes of Failure	Failure Isolation and Remedy
CHECKINTERNVOLTAGE	Problem with the voltages (5V, 12V) in the monitor	Remove all I/O boards and put them back in one at a time to isolate any defective board. If this does not resolve the problem, replace the main board
CHECK MENU LABELS **This message indicates that the monitor has performed a cold start and attempted to reset the menu labels to defaults. If the defaults are present, the recovery was successful. Default settings should be recorder as part of your documented configuration setup. If the menu labels do not match the configuration file settings or the INOP persists, perform the troubleshooting tasks listed in this table.**	Memory space in which the menu labels are stored has been corrupted	Reclone configuration file. This will reload the memory space
	Main Board defective	Replace Main Board
CHECK MONITOR TEMP	The temperature inside the monitor is too high	Check the environment for possible causes
	Monitor ventilation obstructed	Clean the monitor ventilation internally and then cool monitor down for 8 hours
	Main Board defective	replace Main Board
CHECK SETTINGS **This message indicates that the monitor has performed a cold start and attempted to reset the menu labels to defaults. If the defaults are present, the recovery was successful. Default settings should be recorded as part of your documented configuration setup. If the menu labels do not match the configuration file settings or the INOP persists, perform the troubleshooting tasks listed in this table.**	Memory space in which the settings are stored has been corrupted	Reclone configuration file. This will reload the memory space.
	Main board defective	Replace Main board

INOP Message	Possible Causes of Failure	Failure Isolation and Remedy
INTERNAL COMM.MALF.	Problem with the I2C Bus communication in the monitor	Disconnect the external display and try another one
	Video board defective	Replace Video board
	Main board defective	Replace Main board

Remote Alarm Device

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Alarm LEDs illuminate, but no alarm sound is issued	wrong I/O slot	check I/O matrix in the Theory of Operation section of this manual
	speaker defective	replace remote alarm device
	remote device I/F defective	replace I/O board
Alarm occurs on screen, but no LED or alarm sound on the alarm device	cabling not connected	check cabling
	cabling defetive	replace cable
	I/O board defective	replace I/O board
	Remote Alarm Device defective	replace Remote Alarm Device
Alarm sound is isued, but no LEDs light up	LED failure	Replace Alarm Device

Remote Extension Device

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Remote input device (for example mouse/keyboard) attached to the Remote Extension Device does not function	See tables *Speed Point* or *Keyboard/ Mouse not functioning*	See tables *Speed Point* or *Keyboard/Mouse not functioning*
Buttons on the Remote Extension Device do not function but input device attached is functioning	Remote Extension Device defective	replace Remote Extension Device

Speed Point

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Speed Point attached directly to the monitor not functioning	Speed Point not connected properly	Check cabling
	PS/2 I/O board in wrong slot	Check I/O Matrix in *Theory of Operation*
	PS/2 I/O Board defective	replace I/O board
	SpeedPoint defective	Replace SpeedPoint
Speed Point attached to Remote Extension Box not functioning	Remote Extension Device is not connected to the monitor.	Check cabling and connections
	SpeedPoint not connected properly	Check cabling to SpeedPoint in the Remote Extension Device
	SpeedPoint defective	Replace SpeedPoint
	Remote Extension Device defective	Replace Remote Extension Device
	Remote Device I/O board in the wrong slot	Check I/O Matrix in *Theory of Operation*
	Remote Device I/O board defective	Replace I/O board
Speed Point Knob Rotation, Joystick Control or Selection control not functioning	Speed Point defective	Replace Speed Point
INOP Message CHECK INPUT DEVICES is issued	SpeedPoint or other input device defective	Perform a visual and functional check of all the monitor input devices. Replace input devices if necessary.

Keyboard/Mouse not functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Keyboard/Mouse attached directly to the monitor not functioning	Keyboard/Mouse not connected properly	Check cabling
	Keyboard/Mouse defective	Replace Keyboard/Mouse
	PS/2 I/O board in wrong slot	Check I/O Matrix in “Theory of Operation”
	PS/2 I/O Board defective	replace I/O board

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Keyboard/Mouse attached to Remote Extension Box not functioning	Remote Extension Box is not connected to the monitor or Input Device is not connected to Remote Extension Box	Check cabling and connections
	Keyboard/Mouse defective	Replace Keyboard/Mouse
	Remote Extension Device defective	Replace Remote Extension Device
	Remote Device I/O board in wrong slot	Check I/O Matrix in *Theory of Operation*
	Remote Device I/O board defective	Replace I/O board

Network related problems

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Prompt Message “no central assigned to this bed” is issued	The monitor label is not set in the monitor (if the beds are “monitor labeled” in the Philips Information Center)	Set Monitor Label in Config Mode
	Problem with the Philips Information Center to Switch communication (if the beds are “port mapped” in the Philips Information center	Check PIC to Switch communication, Switch configuration and Firmware status
INOP “Unsupported LAN” is issued.	Network failure	Check if switches, Philips Information Center and Database Server are all running and connected to the network
	Monitor connected to wrong network	Check if monitor has been connected for example to a different hospital network instead of the Philips Clinical Network
	IP address conflict after infrastructure re-installation	Reboot Database Server and Philips Information Center
No connectivity to PIC, no prompt or error message on monitor	Hardware Defect	Check LAN cable connection
		Check NGN Connector board in Monitor
		Check Switch
	Configuration problem	Check switch configuration and firmware revision
Other Bed Overview not available	Configuration Problem	Check configuration in PIC regarding other bed overview (care group assignment)
		Verify configuration of switch (setting of multicast filters)
	This function is not available for wireless beds	Switch to a wired configuration
“Other Bed” Alarms are not appearing	Configuration problem	Verify configuration in PIC, in Monitor (Config Mode) and check that the feature is not temporarily disabled by the user (Bed Info Window)

Wireless Network

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
No central monitoring possible (see also Network related problems)	Monitor is out of range of the access point (in this case the yellow sync LED on the wireless adapter on the bottom of the device next to the power connector is not on steady)	Move monitor back into coverage area
		Verify size of coverage with the site survey tool
	Wireless Adapter has no power (LEDs on adapter are all off)	Check splitter cable and replace if necessary
		Check network adapter board in monitor and replace if necessary
		Check adapter itself. Replace if necessary
	(Only after first install) Firmware revision in adapter is wrong	Update adapter frimware with wireless support tool
	Wireless adapter defective (the red status LED on the adapter's top panel is on)	Replace wireless adapter
	Wrong configuration in wireless adapter or in access point	Check configuration with wireless support tool
No connectivity (coverage area consists of multiple access points and in some parts of the area there is no connectivity)	Configuration problem	Verify the channel, domain and security ID settings of the access points in the coverage area
Frequent dropouts and network disconnects	Excessive interference by other radio equipment or by microwave ovens	Check statistics that can be read from the wireless adapter via RS232 or via logging application in the PIC. Remove interfering equipment.
	System capacity exceeded in coverage area	Check configuration guidelines for number of monitors per access point.
	Configuration problem	Check access point configuration with wireless support tool, in particular the multicast filters
Overview, Printing does not work	Some functions are not available on a wireless network	Connect to cabled network

Multi-Measurement Server

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Prompt message “Measurement Server Configuration not supported” is issued	An unsupported Measurement Server Extension has been connected	Disconnect the measurement server extension
	Measurement Server Extension is defective	Replace Measurement Server Extension
	Measurement Server defective	Replace Measurement Server
INOP Message “MsmtSrv not Supp” is issued	Wrong Software Revison	Upgrade monitor and/or measurement server to a matching software version
	Too many measurement servers connected	Disconnect unsupported measurement servers for proper operation
	Unsupported type of measurement server (for example M3000A on a M800xA monitor) connected.	Disconnect the unsupported measurement server
Prompt message “Measurement Server not supported, unplug device, switch monitor off/on” and INOP “Bad Measurement Server are issued	M3000A Measurement Server Revision A is plugged. This Measurement Server is not compatible with the IntelliVue patient monitors	Disconnect the measurement server and cycle power.

MSL-related problems

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Measurement Server does not start up (no LEDs active), no INOP or prompt displayed	No Power	Check MSL cable and replace if necessary
		Check MSL connector board and replace if necessary
Measurement Server does not start but LEDs are normal	Communication lines in MSL cable or MSL connector broken	Check MSL cable and MSL connectors
	MSL connector board defective	Check MSL connector board and replace if necessary
MSL Power High INOP is issued **Note: if this condition persists for longer than 15 minutes, the INOP MSL Power Off will appear (see below)**	Attached devices drawing too much power from the monitor. Too many FMS and MMS connected to the monitor	Reduce to a limit of 1 FMS and 1 MMS connected to the monitor
MSL Power Off INOP is issued	Attached devices drawing too much power from the monitor. Too many FMS and MMS connected to the monitor	Disconnect all FMS and MMS from the monitor Cycle power to restore power to the MSL devices. If the message disappears, reconnect FMS and MMS one at a time, waiting 15 minutes between each device to see if message reoccurs. If yes, the respective MMS or FMS is faulty. See Multi-Measurement Server or Flexible Module Server for troubleshooting tasks. If no, add front-end modules one at a time, waiting 15 minutes between each module to see if message reappears, Replace module if faulty. **Note: If an individual defective device is connected the MSL Power High or MSL Power Overload INOPs will appear initially. The MSL Power Off INOP will not occur for at least 15 minutes.**
MSL Power Overload INOP is issued	Short Circuit within MSL system	Disconnect all MSL connections including Measurement Server Mount, 2nd MSL interface, 1st MSL interface. Reconnect devices one at a time. If message persists, replace main board.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP BAD SERVER LINK is issued	Unexpected data detected on MSL	Check cable and power cycle the monitor
	An FMS or MMS with an incompatible software revision is connected to the monitor.	Connect FMS or MMS with compatible software revsion
	Communication between the components not functioning	Check software versions and model number of devices for compatibility
INOP Message SERVERLINK MALF is displayed, audible indicator: a beep every two seconds	The hardware for communicating with the Multi-Measurement Server is faulty.	Check MSL cable, replace if necessary.
		Check MSL I/O board. Replace if necessary
		Check FMS or MMS connector board. Replace if necessary.
A measurement supported by a server does not come up on the monitor	Label conflict	A parameter label from this measurement is already in use in the monitor. Check the conflict window to select the measurement.
Prompt message “Too many <label> modules connected” is issued	There are more modules of the type <label> connected than supported by the software	Remove the unsupported module or use the lebel manager application in the monitor to disable the module.
The ECG Out/ Marker In function does not funcion	Hardware problem	Check MSL cable
		Check ECG Out Hardware in the monitor
		Check the MSL connector in the measurement server

Alarm Issues

Alarm Lamps

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message Check Alarm Lamps is issued	Alarm LED board cable disconnected	reconnect cable
	Alarm LED board defective	replace Alarm LED board
	Main board defective	replace Main board
Alarm occurs, but no LED lights up	Environmental Lighting too bright	Place monitor in a darker environment
	Light pipes broken off	replace light pipes
	Alarm LED board cable disconnected	reconnect cable
	Alarm LED board defective	Replace Alarm LED board
	Main Board defective	Main board

Alarm Tones

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message SPEAKER MALFUNCTION is displayed	Speaker cable disconnected	Reconnect speaker cable
	Speaker defective	Replace speaker
	Sound amplifier on main board defective	Replace main board
Alarm occurs but no alarm sound is issued	Audible alarm indicators have been switched off	Switch audible alarm indicators back on
	Volume set to 0	Increase volume
	Speaker defective	Replace speaker
	Sound amplifier on main board defective	Replace main board
Alarm occurs on device connected to VueLink but no alarm sound is issued on the monitor	Configuration of VueLink is incorrect	Check VueLink configuration

Alarm Behavior

If your monitor did not alarm in the way in which the end user expected, please consult the Instructions for Use for possible setup issues or configuration settings which could affect alarm behavior.

Individual Parameter INOPS

If any of the following parameter INOP messages are issued try the respective parameter in another device. If the INOP message persists replace the parameter module, the MMS or other indicated device.

- CO_2 EQUIP MALF
- ECG EQUIP MALF
- NBP EQUIP MALF
- P1 EQUIP MALF
- RESP EQUIP MALF
- SpO_2 EQUIP MALF
- SpO_2 TRANSDUC MALF
- SvO_2 EQUIP MALF
- $tcpO_2$ (or $tcpCO_2$) EQUIP MALF
- T1 EQUIP MALF
- VueLnk EQU. MALFI

Flexible Module Server

Symptoms	Cause of Failure	Failure Isolation and Remedy
Prompt Message “Unrecognized Measurement Module in slot s” is issued	An unsupported module has been plugged into the Flexible Module Server	Unplug the unsupported module
Prompt message “Measurement Module in slot n is currently ignored” is issued	Too many modules of the same kind have been plugged into the Flexible Module Server	Unplug module in slot n
Red Error LED stays on	Unrecoverable hardware selftest error:	Try to attach the MMS directly to the MSL cable. If the measurements show up on the screen, the fault is in the FMS
	MSL cable defective	If the measurements do not show up when the MMS is connected directly to the MSL cable, then replace MSL cable
	Flex connector from main board to MSL defective	Replace connector
	CPU module defective	Replace CPU module
Red Error LED flashes	Hardware selftest error	If system comes up, check status log. Otherwise see above
Flexible Module Server LEDs ok, Front End Measurement Module not recognized (no prompt or INOP)	Measurement Module or Measurement Module Connector defective	Replace Measurement Module
	No Front-End power because MSL voltage from the monitor is too high or too low	Try a new MSL cable. Replace if failure is rectified.
		Replace mother board
	Mother board or connector on Mother Board defective	If the voltage is in range, or there is obvious damage to a connector, replace mother board

Integrated Module Slots

Symptoms	Cause of Failure	Failure Isolation and Remedy
Prompt Message “Unrecognized Measurement Module in slot m” is issued	An unsupported module has been plugged into the Integrated Module Slot	Unplug the unsupported module.
Prompt message “Measurement Module in slot n is currently ignored” is issued	Too many modules of the same kind have been plugged into the Integrated Module Slot	Unplug module in slot n

Symptoms	Cause of Failure	Failure Isolation and Remedy
Inserted Module LEDs behave normally but Modules not recognized by monitor	The monitor software version does not support measurement modules	Check software version and options
	Label conflict	See MSL-related problems
Inserted Module does not function	Connector damaged	Replace integrated module slot
	internal ribbon cable not connected or defective	reconnect or replace cable

Printer

Symptoms	Cause of Failure	Failure Isolation and Remedy
Prompt message “Print job could not be queued” is issued. No print device is found.	Printer is disabled in the Setup Printers menu	Enable the correct printer in the Setup Printers menu
	Paper size of printer does not match paper size of report	Change paper size of the printer in the Setup Printers menu or change paper size of the report in the Setup Reports menu.
Status message “Print device Local 1 (Local 2) unavailable” is issued. Printer job is stalled.	Printer not switched on	Switch on printer power
	Printer paper tray empty	fill printer paper tray
	Cabling not connected correctly	Check cabling
	I/O board defect	replace I/O board
Status message “Print device Remote 1 (Remote 2, Remote 3) unavailable” is issued. Printer job is stalled	Print error on Philips Information Center	Print a test report on the Philips Information center. If this fails, refer to Philips Information Center documentation
	Network Connection to Philips Information Center not functioning	Check that the network connection between the monitor and the Philips Information Center is working

Symptoms	Cause of Failure	Failure Isolation and Remedy
Status message “Printing on device Remote 1... (Remote 2, Remote 3)” is issued but no report is printed	Print queue on Philips Information Center is full. Reasons for this may be: - Printer is not switched on - Printer paper tray is empty	Switch on printer power Fill printer paper tray
Printouts are not as expected	Printer paper size is not correctly configured Printer resolution is not correctly configured Printer color support is configured to “On” although the printer does not support color Printer not compatible	Configure the paper size according to the inserted print media Configure the printer resolution according to the printer capabilities Configure the printer color support to “Off” Check specifications

Recorder

Symptom	Possible Cause	Corrective Action
System thinks that door is open when it is not.	Defective door switch.	Replace door switch. Exchange module.
System thinks that the recorder is out of paper when it is not.	Paper-out sensor dirty.	Clean paper-out sensor.
Recorder not communicating with System.	Poor connection to the front-end FMS.	Unplug the module. Plug it back in and try it again in a few seconds. (Watch for the LED to flash.)
	Only one recorder module may be used with each monitor.	Remove one of the recorder modules.
	System not configured properly.	Check the configuration of the connected monitor.
	Too many modules connected.	Check and remove the extra modules.
Recorder won't run.	Recorder interface not working correctly.	Unplug the module. Plug it back in and try it again in a few seconds. (Watch for the LED to flash.)
Poor print quality.	Printhead dirty.	Clean the Printhead as described in “Cleaning the Recorder Module” on page 2-24 of this manual.
	Printhead failure.	Exchange the module.

Symptom	Possible Cause	Corrective Action
Paper not feeding properly.	Paper roll off center.	Center paper roll on roller guides.
	Dirty roller.	Clean roller.
Module does not lock into FMS.	Locking plates defective.	Remove and exchange the locking plates.

MIB / RS232

Symptoms	Cause of Failure	Failure Isolation and Remedy
AGM connected to an RS232 port not functioning	The MIB/RS232 port is not configured for AGM	Check configuration of the MIB/RS232 ports in configuration mode
	The cable between AGM and monitor is not connected correctly or defective	Check cable connection, replace cable if necessary
	The MIB/RS232 board is in a wrong slot (slot has been changed after software configuration or an additional board has been plugged in)	Verify correct placement of the I/O boards
	The MIB/RS232 board is defective	Check board and replace if necessary
External device not receiving data	The MIB/RS232 port is not configured for data export	Check configuration of the MIB/RS232 ports in configuration mode
	The wrong data export protocol driver is configured in the monitor	Check the export protocol required by the attached device and configure the monitor accordingly
	The cable between the external device and the monitor is not connected correctly or defective	Check cable and replace if necessary
	The external device does not support the version of the data export protocol used in the monitor	Check if the device supports the version of the data export protocol. Upgrade device or monitor if necessary (if matching versions exist).
	A terminal concentrator is used in between the device and the monitor and a protocol with dynamic speed negotiation is used	Some terminal concentrators do not support changing the transmission speed (baud rate) dynamically. Check if the connection works without the concentrator
	The MIB/RS232 board is in a wrong slot (slot has been changed after software configuration or an additional board has been plugged in)	Verify correct placement of the I/O boards
	The MIB/RS232 board is defective	Check board and replace if necessary
Detailed Protocol Problem		Consult the Data Export Protocol document.

Flexible Nurse Call Relay

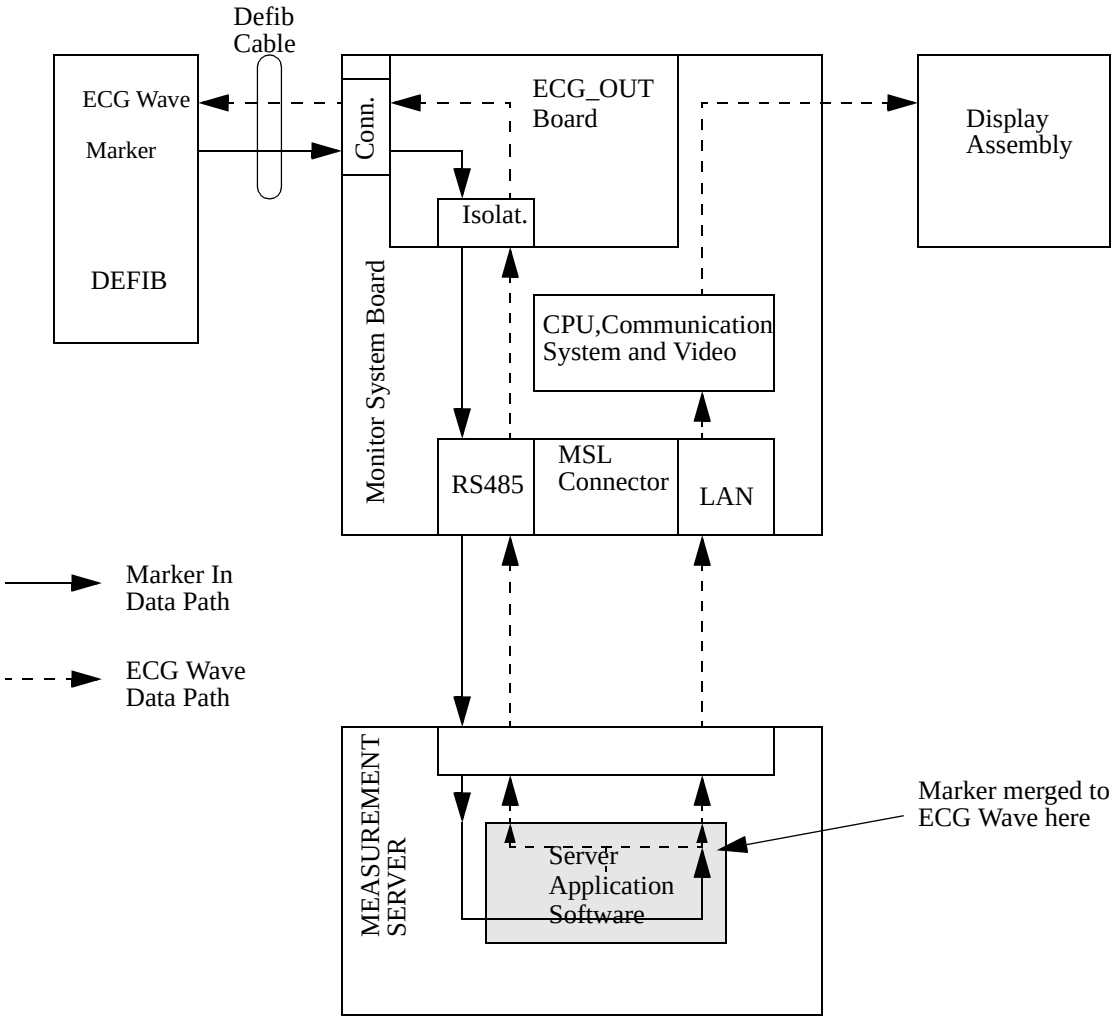
Symptoms	Cause of Failure	Failure Isolation and Remedy
INOP message CHECK NURSE CALL RELAY is issued	Nurse Call Relay board defective	Replace Nurse Call Relay I/O board.
Monitor alarmed, Nurse Call did not activate	Incorrect configuration (Relay latency, Relay trigger)	Check monitor configuration (see configuration guide)
	Connection of cable to monitor or nurse call system not correct	Check cable connections
	Nurse Call Relay board is in the wrong slot.	Verify correct placement of the I/O boards
	The Nurse Call Relay bosrd is defective	Replace Nurse Call Relay board

Troubleshooting the ECG OUT

Symptoms	Cause of Failure	Failure Isolation and Remedy
No marker pulse is displayed on the Monitor or no ECG- OUT signal to the Defib		Disconnect the MMS and Defib cable. Switch the Monitor off then on again. Observe the red LED in the ECG OUT section. (Note that the LED can only be observed if the housing bottom is removed).
	Cabling not connected	**If the red LED does not switch on for about 1 second at power on:** Check cabling
	ECG OUT board defective	Replace ECG OUT board
	ECG OUT Board defective	**If the red LED switches on and remains on for more than 20 seconds:** Replace ECG OUT Board
	Main Board defective	Replace Main Board
	ECG OUT board defective	Connect Known good Defib, Defib cable MMS and MMS cable. Check Marker pulse and ECG OUT signal at defib again. **If there is still no signal:** Replace ECG OUT board
	Main Board defective	Replace main board

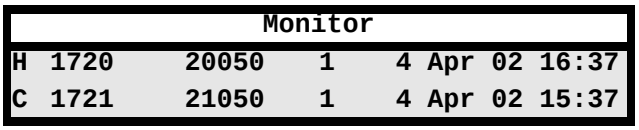
Data Flow Marker In and ECG Wave

The following illustration of the data flow for Marker In and ECG Wave may assist in troubleshooting.



Status Log

Many events that occur during start-up or regular monitoring are logged in the Status Log. The Status Log can be printed and cleared. Not all entries in the Status Log are errors.



The window title is either **Monitor** or **MeasServ**, dependent on which system component's status log is currently displayed.

The Status Log window shows logged events which caused a reboot of the system component (monitor or measurement server).

The first column in the log identifies the event class ("C": caused a cold start, "H": caused a hot start, "N": no retstart, for information only). Column 3 and 4 identify the event source and event code. Column 4 counts the number of occurrences of the event. The last column shows the time and date of the last occurrence of the event.

The following pop-up keys overlay the SmartKeys:

Clear StatLog

This key clears the currently displayed Status Log

Revision

This key switches to the Revision Screen of the currently displayed system component

M8005

This key switches to the Monitor Revision Window

M8048

This key switches to the Flexible Module Server (FMS) Revision Window

M3001

This key switches to the Multi Measurement Server (MMS) Revision Window

If an event occurs repeatedly, contact your Philips Service Representative.

NOTE It is possible, using the support tool, to download the status log and send it to your Philips Service Representative as a file (for example via e-mail).

Troubleshooting with the Support Tool

Using the support tool you can:

- access the full status log which can be saved as a file
- reload software

- identify defective devices
- reset touch screen calibration

For details on how to perform these tasks see the Support Tool User Manual.

Troubleshooting the Individual Measurements or Applications

For problems isolated to an individual parameter or application such as event review, please consult the Instructions for Use and configuration information.

If the instructions for use did not resolve an individual parameter problem, then another module or measurement server should be tried.

If you are getting questionable readings for individual measurements you may want to do the Performance Verification tests in the *Testing and Maintenance* section.

The performance of the individual applications (event review, arrhythmia, trending) are affected by the configuration of the monitor. When contacting Philips support you may be asked about the configuration of the monitor to aid in troubleshooting.

5

Repair and Disassembly

The following section describes the disassembly and reassembly procedures for the monitor and its components

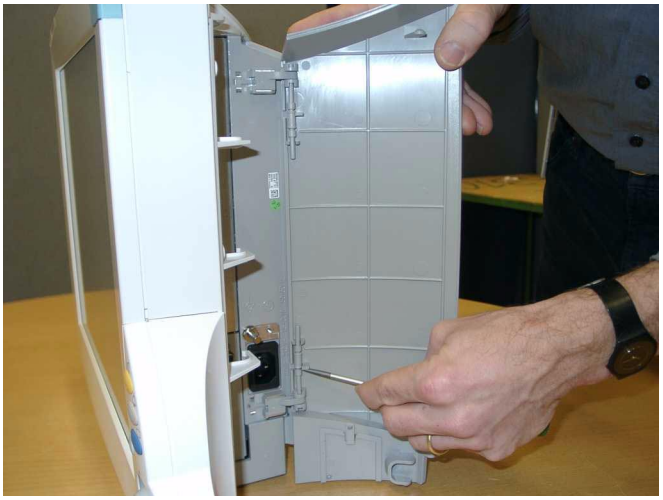
Tools Required

- Torx screwdrivers (sizes 6,10,20)
- 5/16" (5mm) Allen Wrench
- 2 Small flat head screwdrivers
- Needle Nose Pliars
- ESD mat and wrist strap
- 1 small Pozi or Philips head screwdriver

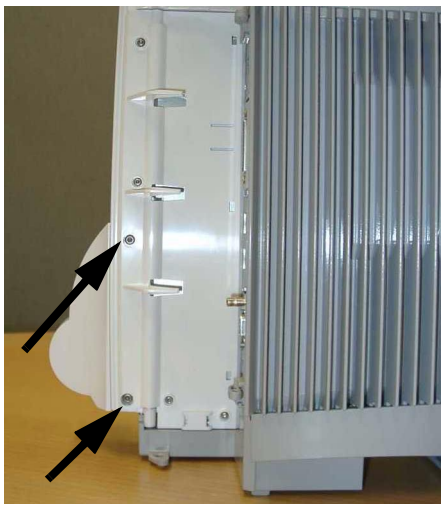
Minimal Monitor Disassembly

Disconnecting the SpeedPoint

1 Remove the cable management cover by sliding the upper pin down and the lower pin up with a screwdriver.



2 Remove the two large screws with a T20 screwdriver.

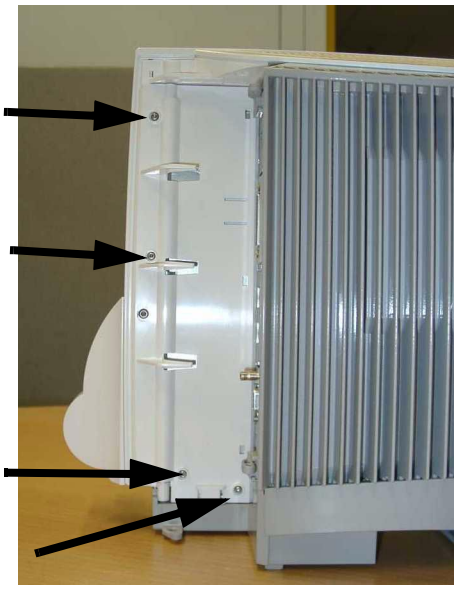


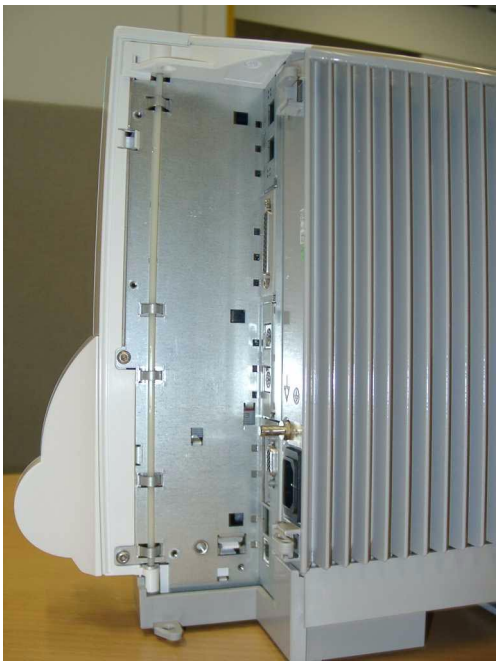
3 Disconnect the SpeedPoint cable and pull off the SpeedPoint.

Removing the I/O Boards

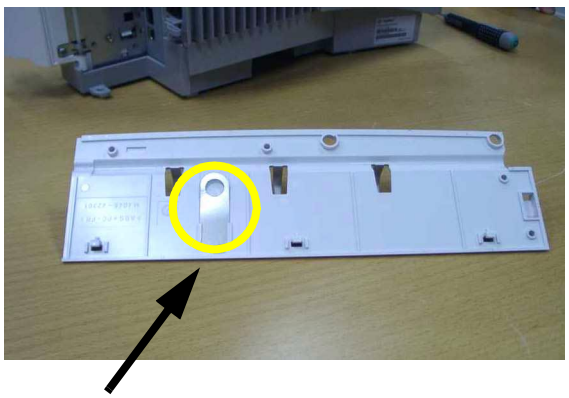
1 Remove the cable management cover as described in *Disconnecting the SpeedPoint*.

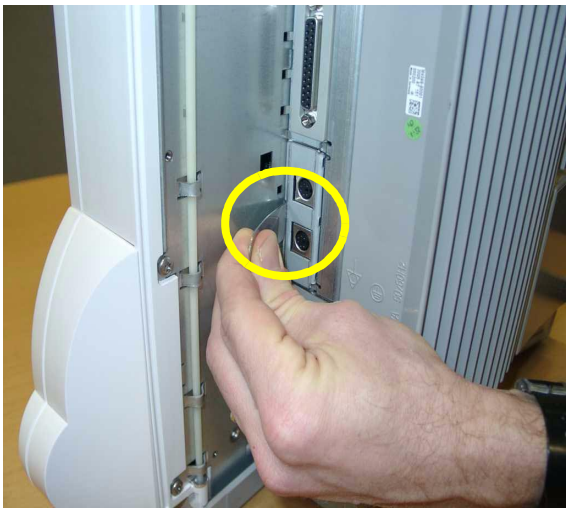
2 Remove the four small screws with a T10 screwdriver and take off the white plastic cover.





3 Use the board removal tool located inside the white cover to pull out the I/O boards.





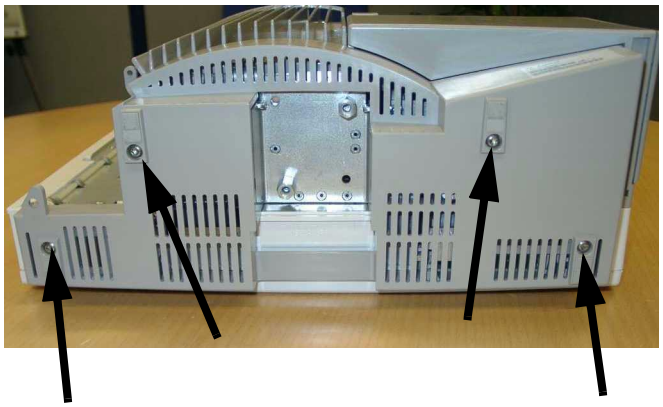
Reassembly Note: You must place the MSL/LAN board in the bottom slot. For correct placement of the boards, see *I/O Boards* in the *Theory of Operation* section.

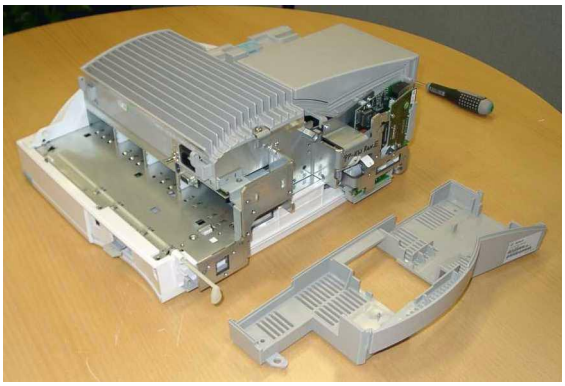
Removing the ECG Out board if no SRL2 board is plugged

For instructions on removing the ECG Out board when an SRL2 board is plugged see *Removing the ECG Out Board with an SRL2 Board plugged*.

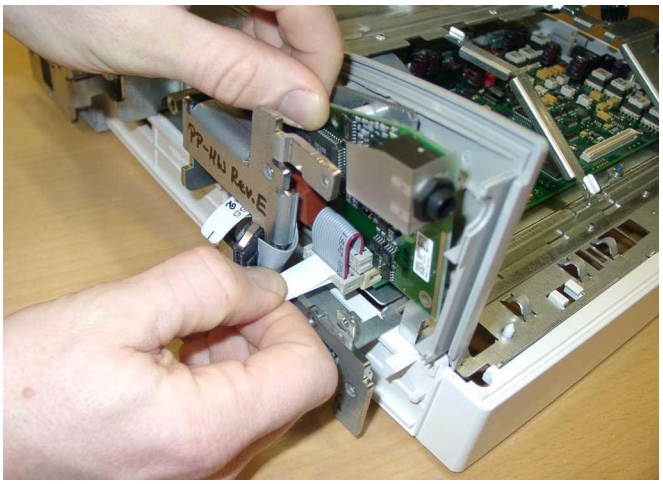
1 Remove the mounting plate from the monitor if attached.

2 Remove the four screws with a T20 screwdriver and pull off the bottom cover.





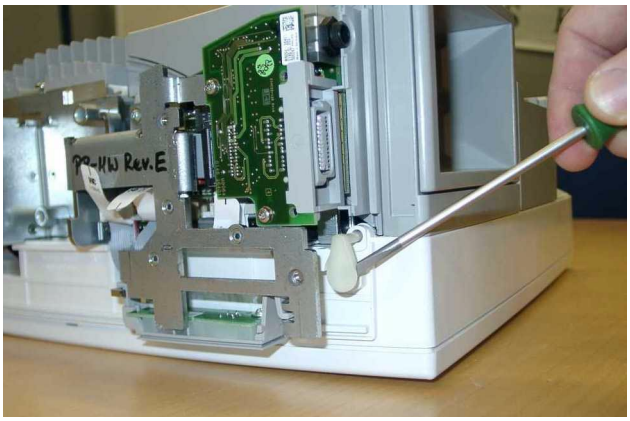
3 Unscrew the screws on the ECG Out board and pull on the tab to remove the cable.



Removing the Integrated Module Slot, the Measurement Server Mount or blank covers

1 Remove the bottom cover as described in *Removing the ECG Out board if no SRL2 board is plugged*.

2 Pull out the two pins (one on each side of the monitor) using a flat screwdriver.



Reassembly Note: When reassembling the monitor, the bottom end of the pins should snap into the plastic holders.

3 Lift off the integrated module slot and the measurement server mount (if installed) and unplug their cables from the main board. If no integrated module slot or measurement server mount is installed, remove the blank covers.

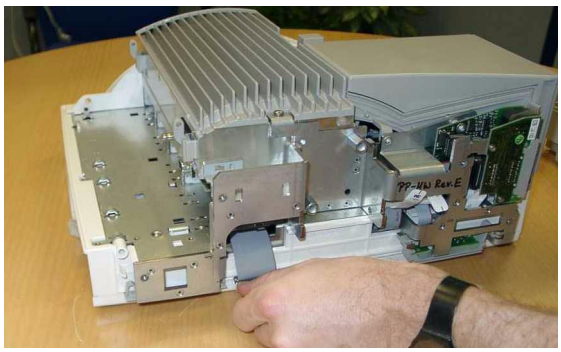
Reassembly Note: Reattach the cables first before putting the integrated modules slot or measurement server mount in place.

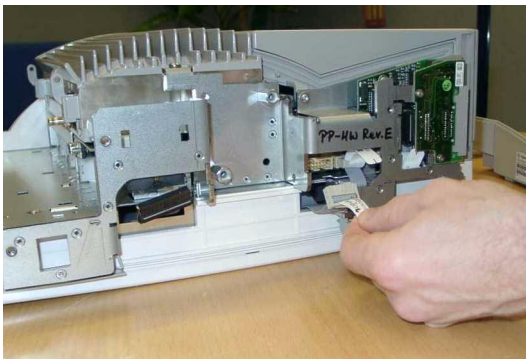
Separating the front and back half of the monitor

1 Remove the bottom cover as described in *Removing the ECG Out board if no SRL2 board is plugged*.

2 Remove integrated module slot and measurement server mount as described in *Removing the Integrated Module Slot, the Measurement Server Mount or blank covers*.

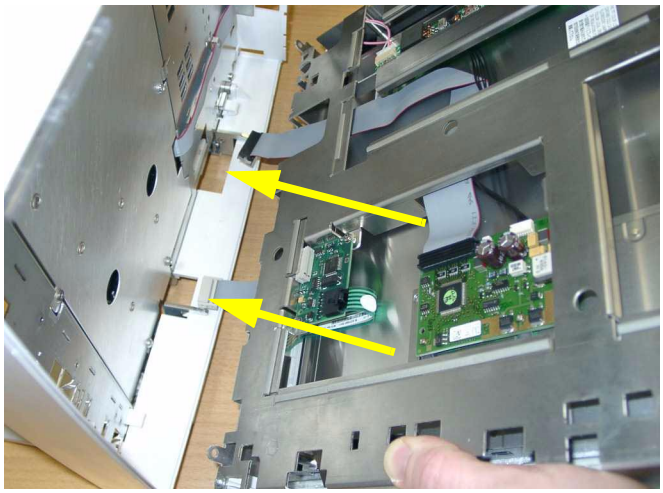
3 Unplug the video cable by pulling downwards and the touch controller cable by pulling outwards on the tab.

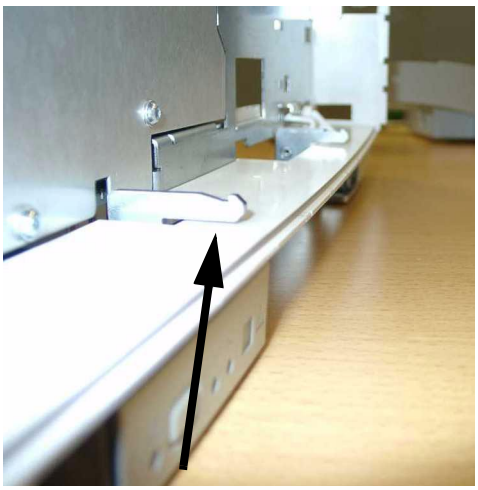




4 Place the monitor in an upright position and pull off the display assembly.

Reassembly Note: When reassembling the monitor, make sure you insert the cables into the slots at the bottom of the assembly and to slide the display assembly into its hooks.



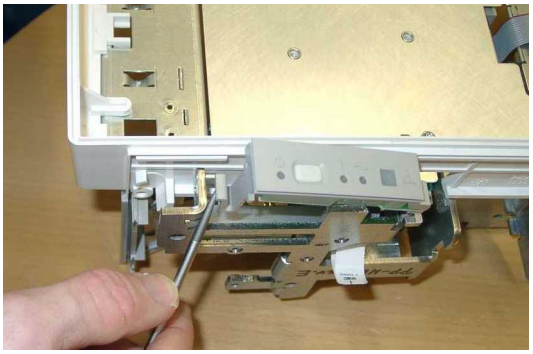


Removing Power Switch board

1 Separate the two halves of the monitor as decribed in *Separating the front and back half of the monitor*.

2 Pull out the power switch connector on the tab.

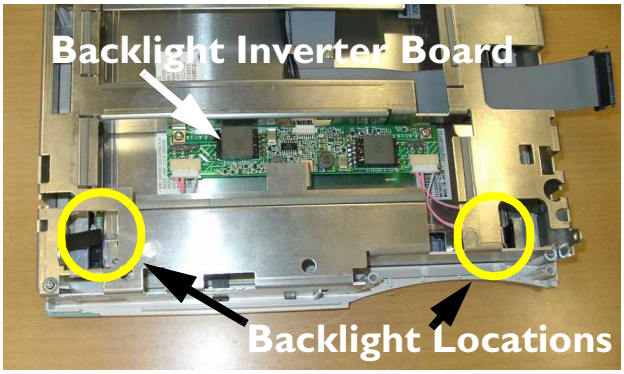
3 Remove the power switch board including its cover by pressing the plastic spring to the right using a flat screwdriver.

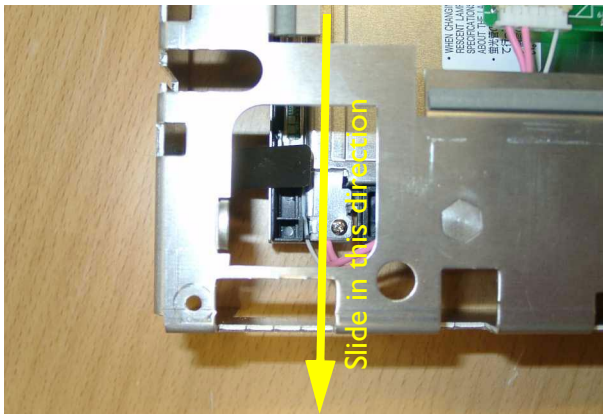


Removing the Backlights

1 Remove the two screws that hold the backlight assemblies in place.

2 Remove the cables from the backlight inverter board and slide the backlight assemblies gently out of the side.





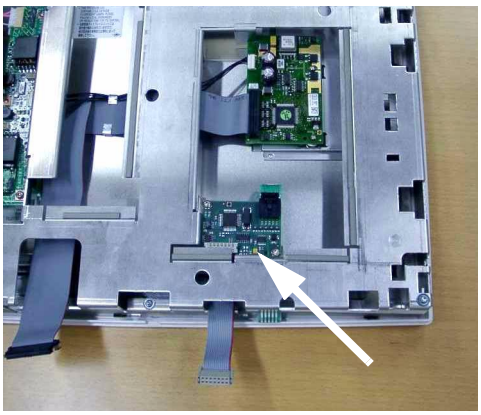
Further Disassembly

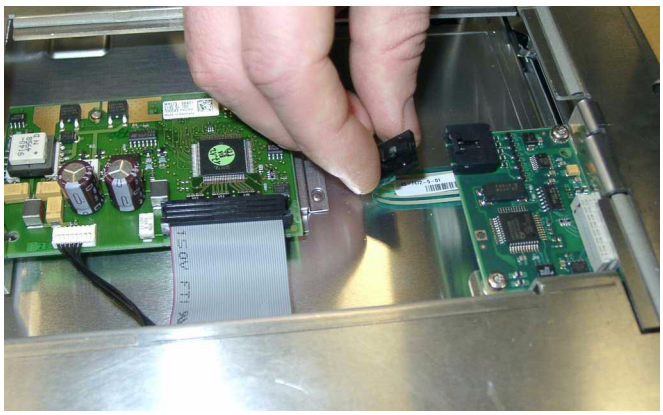
Exchanging the Touchscreen

CAUTION This procedure must be performed in a dust free environment.

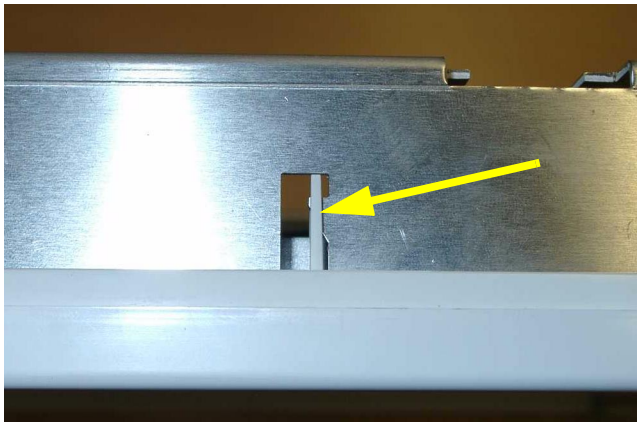
1 Separate the two monitor halves as described in *Separating the front and back half of the monitor*.

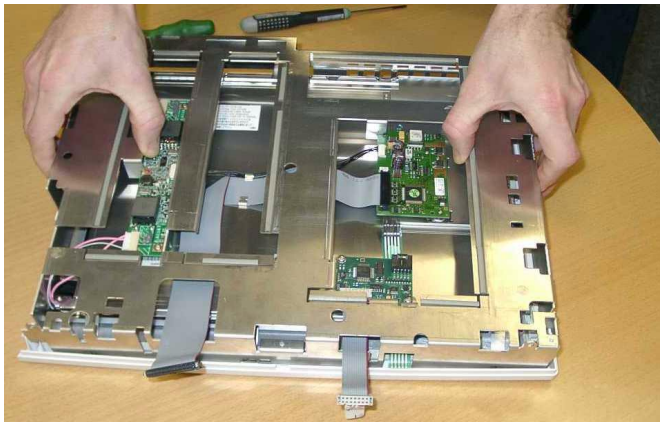
2 Unplug the cable from the touch controller board to the touch panel and remove the six screws that hold the plastic bezel with a T10 screwdriver.





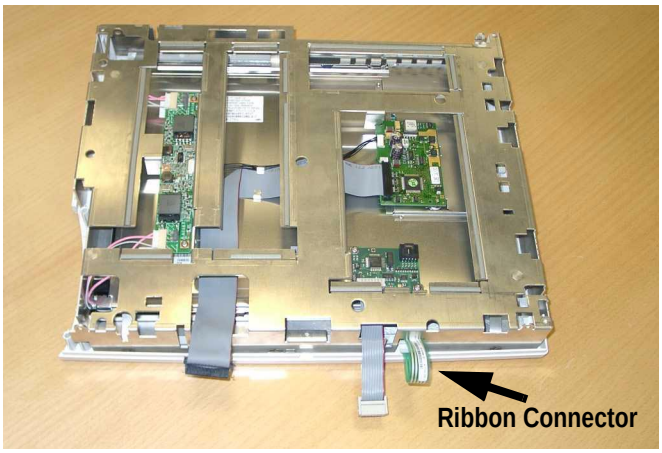
3 Release the snaps on the side and pull off the display assembly from the panel.





Reassembly Notes:

- You must replace the touch panel and touch controller board together. The monitor will not operate if they do not match.
- Orient the touch panel assembly to the LCD assembly and feed the ribbon connector upwards when reassembling.

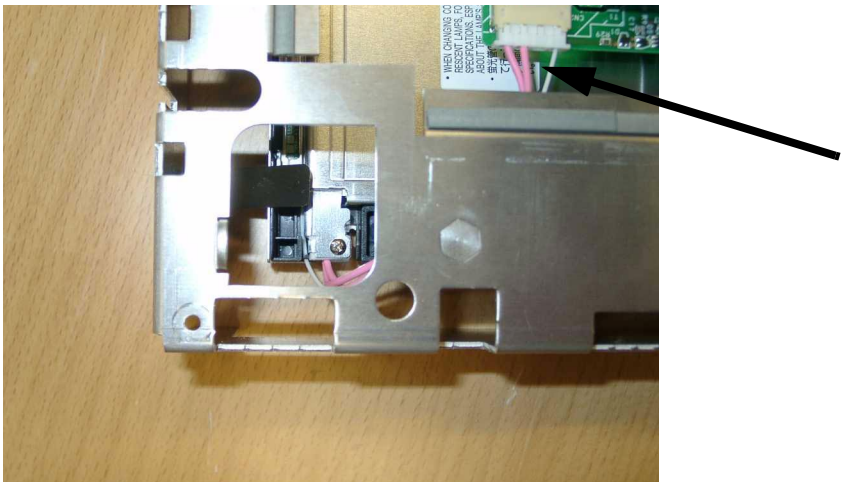


Exchanging the LCD Assembly

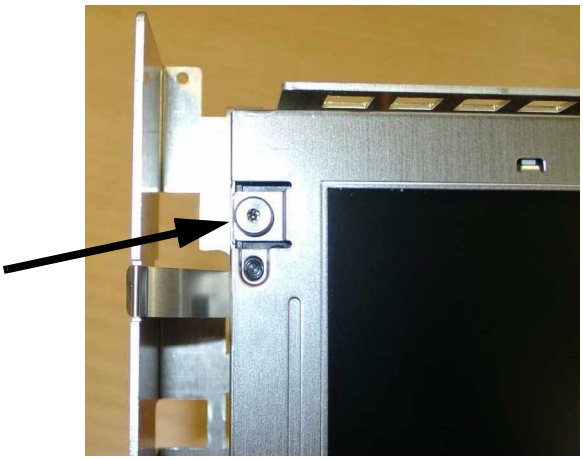
1 Pull off the LCD panel display adapter.

CAUTION Do **not** touch the LCD Panel.

2 Remove the backlight tube cables.



3 Remove LCD panel by unscrewing the two special screws on the top and the two regular screws on the bottom with T10 screwdriver.



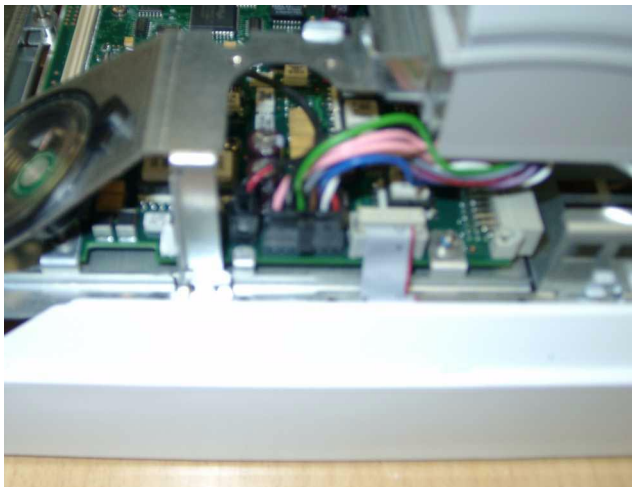
Removing Power Supply

1 Remove the cable management cover and the white plastic cover as described in *Removing the I/O Boards*.

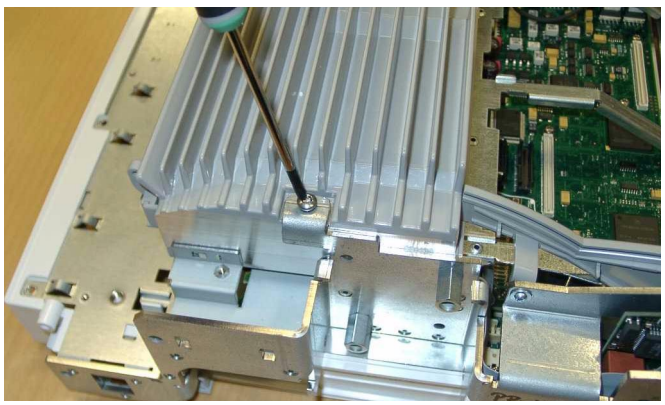
2 Remove the top cover on the back of the monitor. It snaps off in two pieces, the middle one first.

3 Lay the monitor face down, with the top facing towards you.

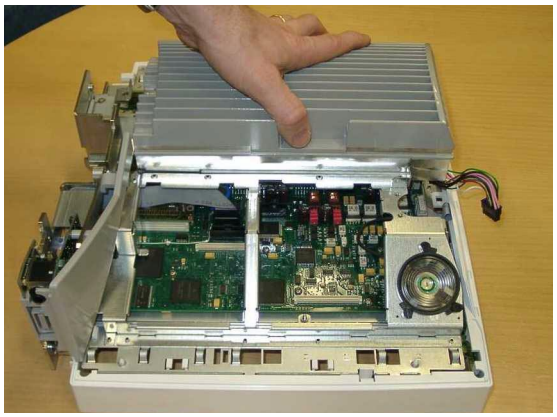
4 Unplug the multicolored power supply cable.



5 Remove the two screws (one on the top, one on the bottom) using a T20 screwdriver.



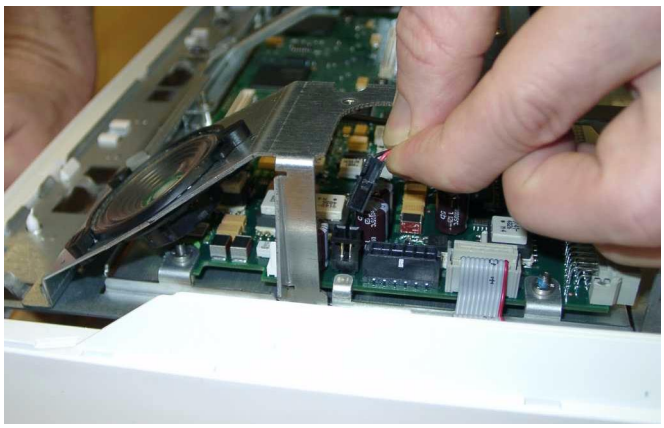
6 Shift the power supply towards the top of the monitor and lift it off.



Reassembly Note: When reassembling, you must shift the power supply into place towards the bottom of the monitor (reverse motion to step 6 above).

Removing the Speaker

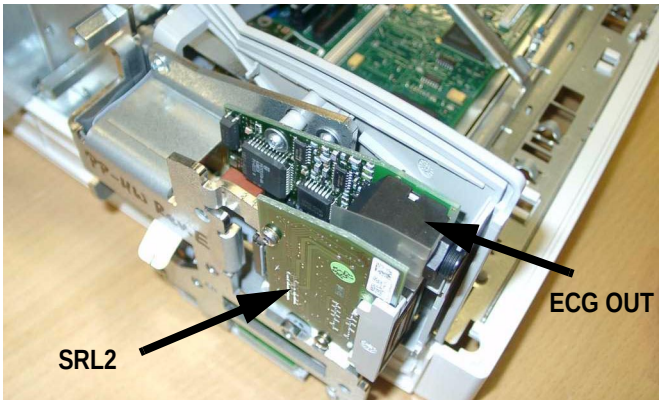
1 Unplug the speaker cable.



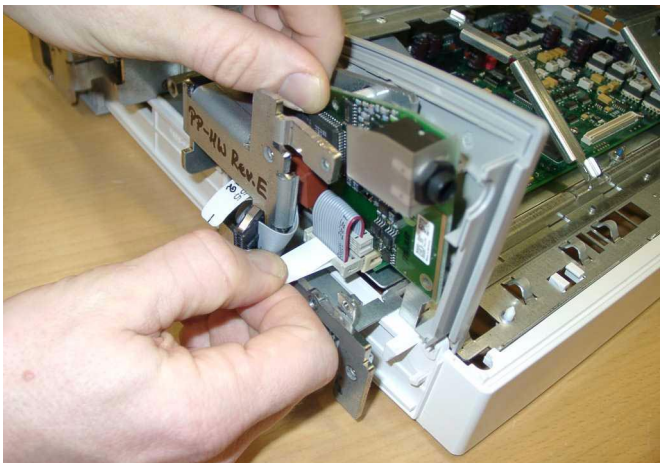
2 Loosen the black plastic screws, rotate the speaker and pull it out.

Removing the ECG Out Board with an SRL2 Board plugged

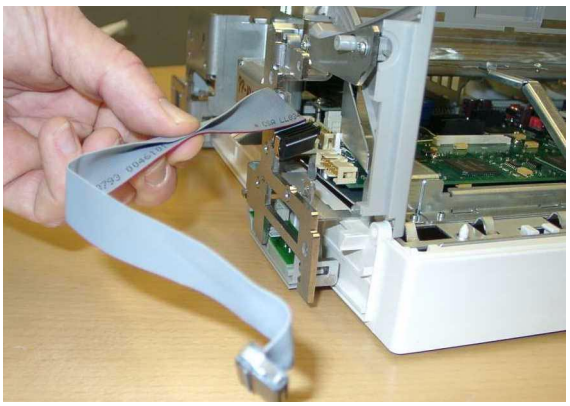
1 Remove the screws on the SRL2 board and unplug the cable to the main board and remove the board. You cannot unplug and remove the SRL2 cable completely from the main board until you remove the ECG Out board.



2 Unscrew the two screws on ECG Out board and pull on the tab to remove the board



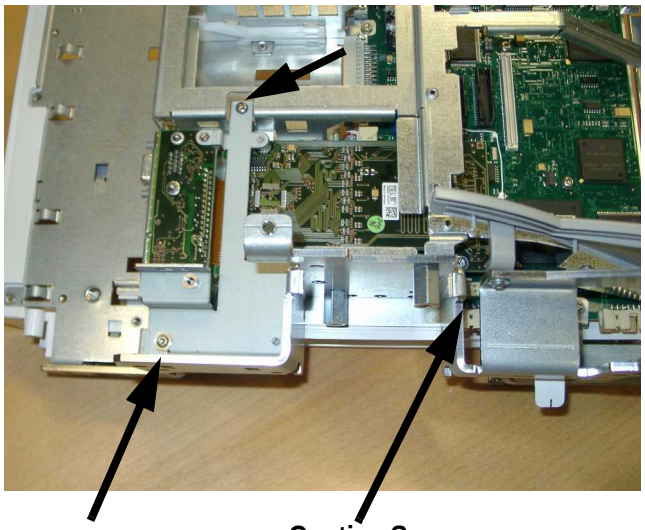
3 Pull the SRL2 cable out of the main board and remove it completely.

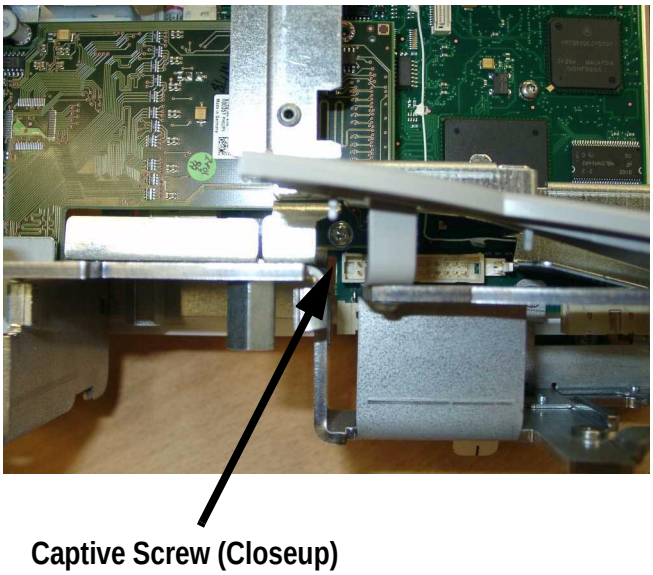


Reassembly Note: The component side faces the ECG Out board. The board sits outside the sheet metal. Plug in the cable first.

Removing the Video Board

1 Remove the three screws and unplug the video board connector from the main board.

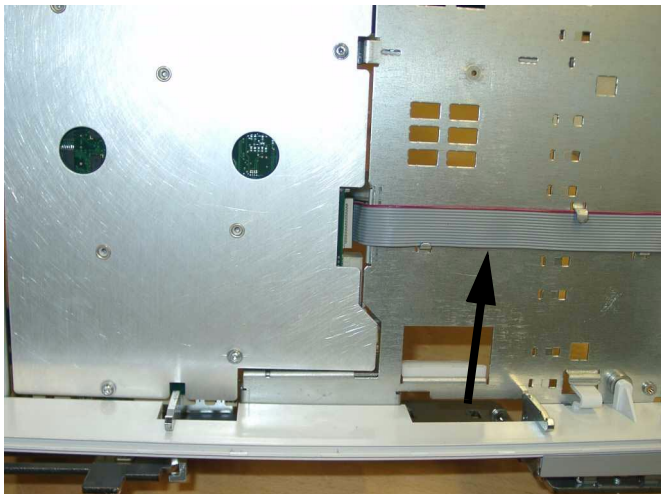




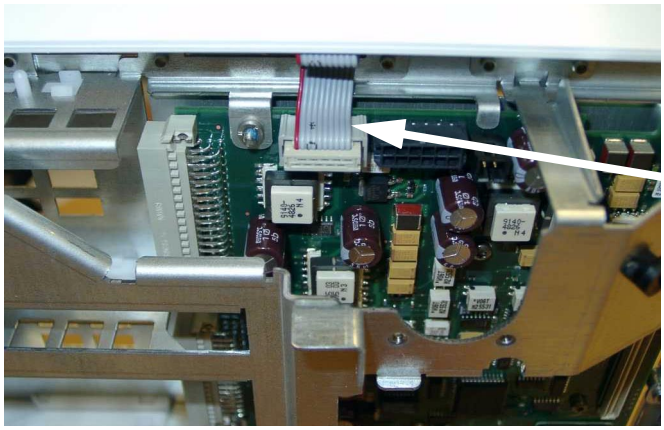
2 Pull up the board and slide it out

Removing the Main Board

1 Unplug the cable to the SpeedPoint (if installed).

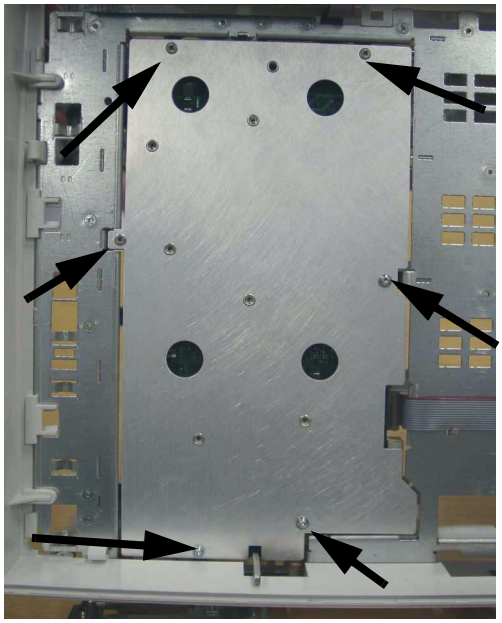


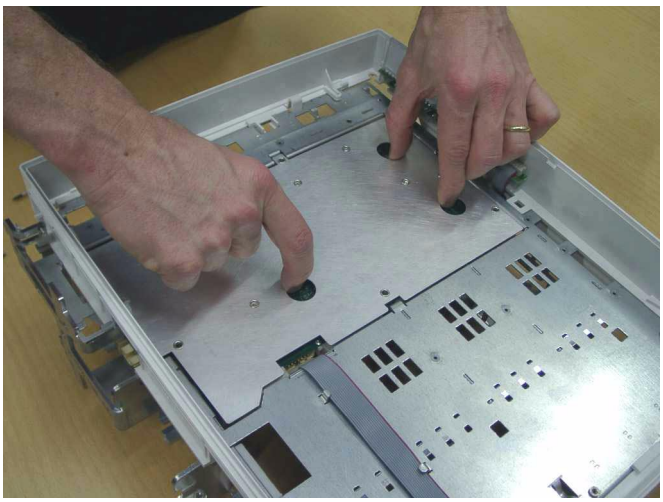
2 Remove the LED board connector.



Reassembly Note: Reach under and plug in the cable on the side without the sheet metal.

3 Remove the six screws on the back and lift the board out together with its metal stabilizer.





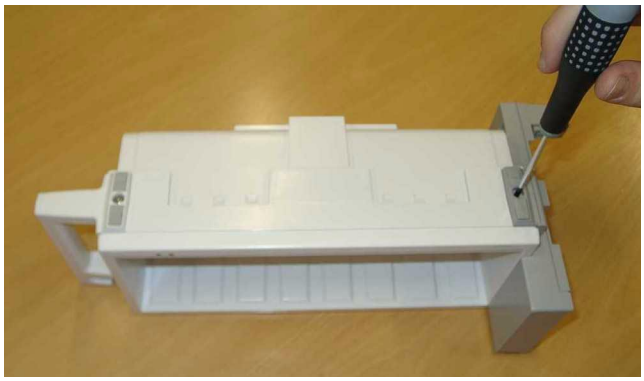
Reassembly Note: Replacement main boards do not come with a metal stabilizer. You must remove the stabilizer from the old board and attach it to the new one.

Flexible Module Server (FMS) Disassembly

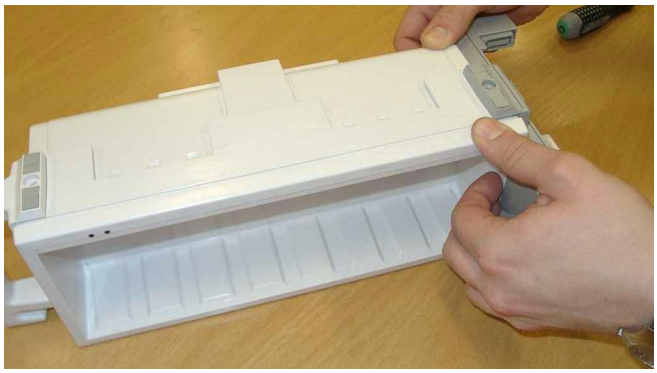
Removing the Handle and the Measurement Server Mount

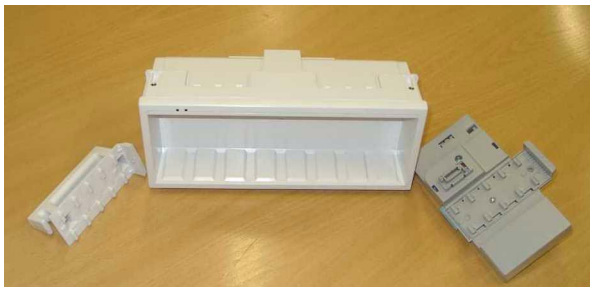
Please note that any combination of handles and mounts is possible.

1 Remove the two screws on the bottom with a T20 screwdriver.

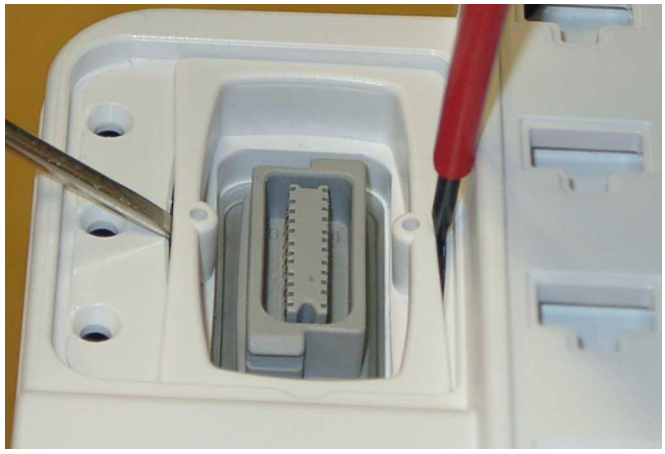


2 Slide the handle up and pull it out. Unplug the MMS connector and pull off the mount.

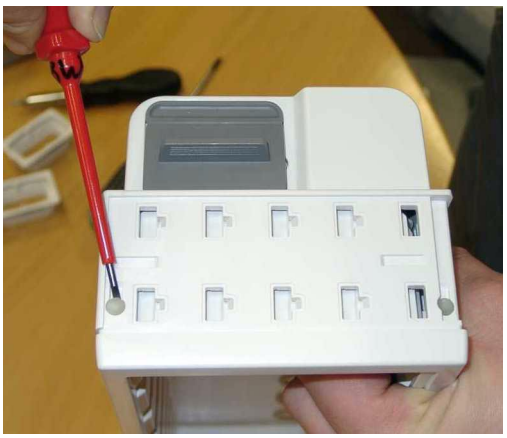




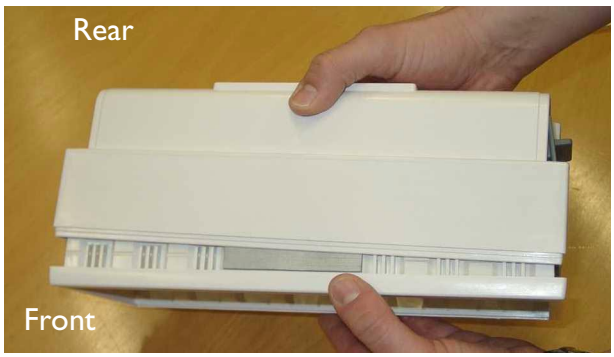
3 Remove the connector housings on each side of the FMS by compressing the cover slightly using two screwdrivers.

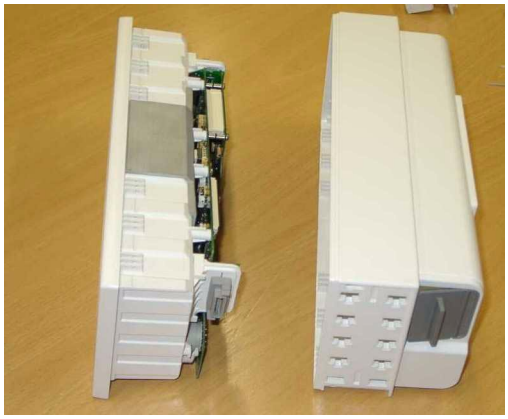


4 Remove the two white pins on each side with a small screwdriver.

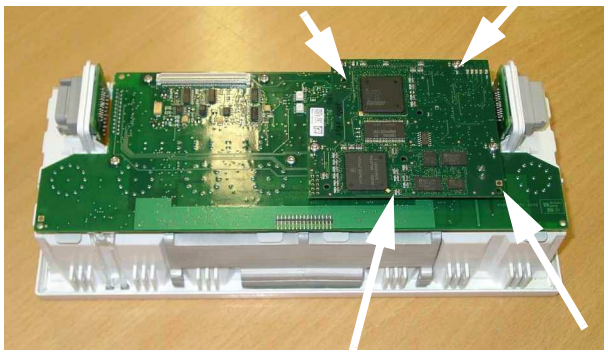


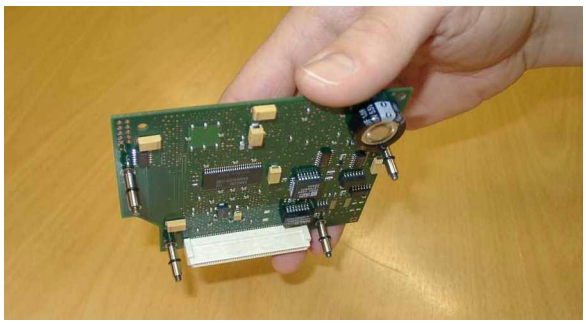
5 Take off the rear housing.



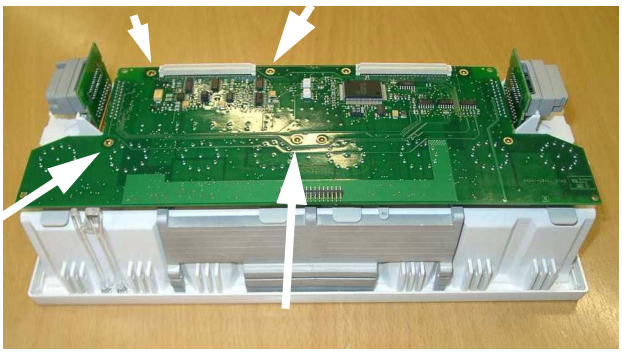


6 Remove the four screws on the CPU board, pull it gently off the mother board, unplugging the connector at the same time.





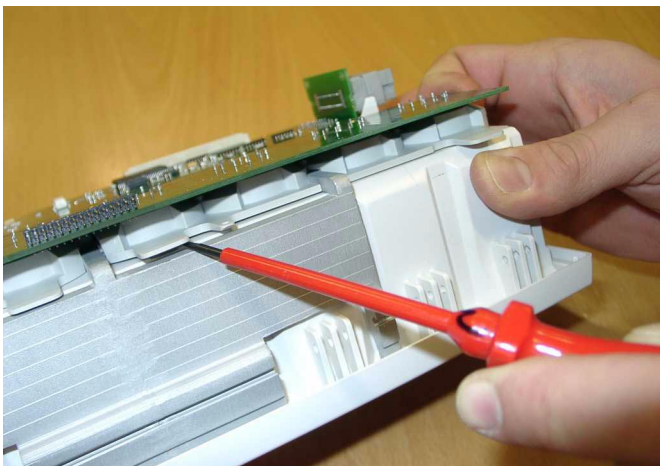
7 Remove the four remaining screws on the mainboard.

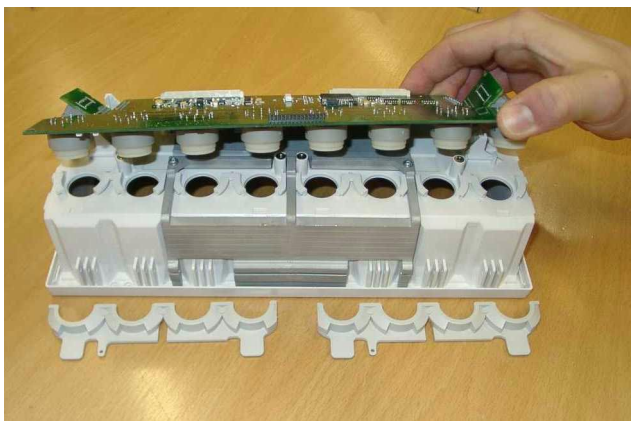


8 Pull off side connector brackets by pulling them gently away from the housing on each side and lifting carefully.

9 Lift up and pull on the tabs to remove the connector holders.

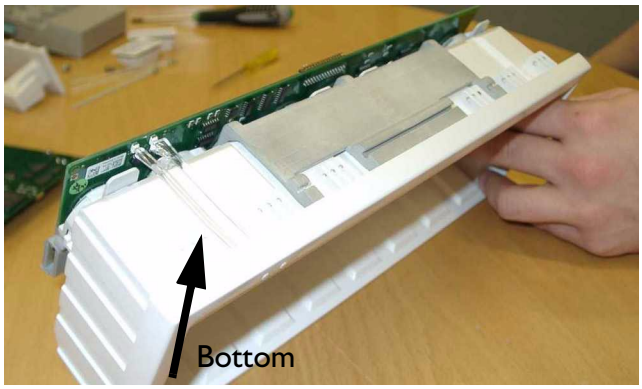
Reassembly Note: The connector holders are side specific.

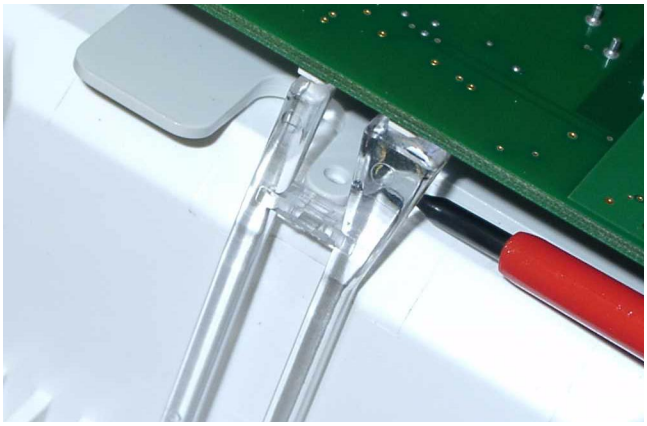




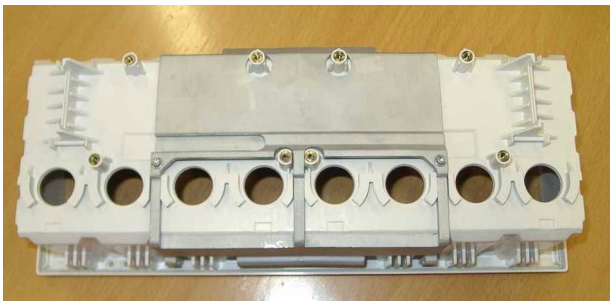
10 Unsnap the lightpipe.

Reassembly Note: You must snap the lightpipe bottom into place before inserting the top into the tab.

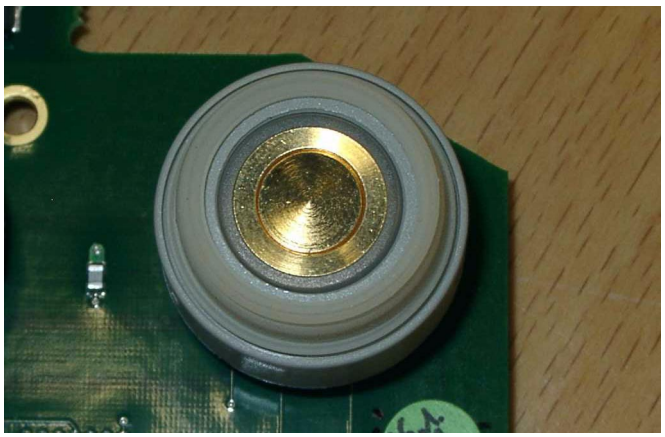




11 Pull off the main board.

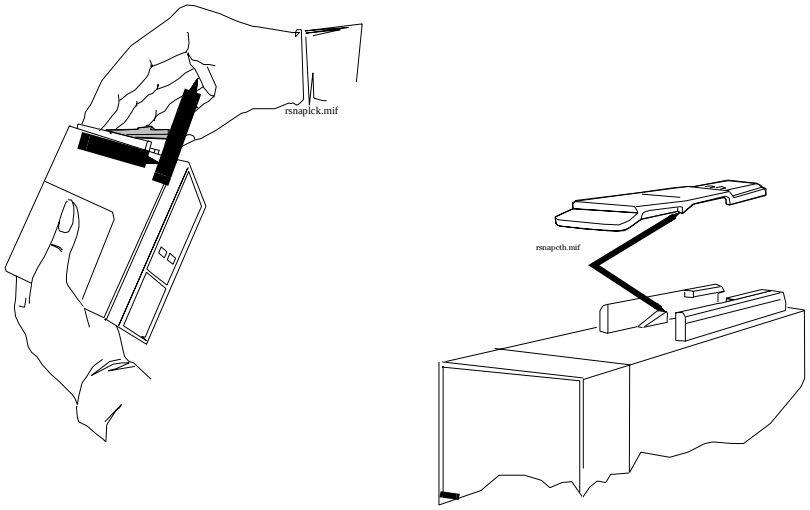


Reassembly Note: Make sure that the rubber seal around the module connectors is inserted properly into the front housing.



Plug-in Modules

The snap lock holds the plug-in module in the FMS.



To remove the snap lock:

1 Grip the module firmly in one hand and using your thumb, pull the front edge of the snap lock away from the plug-in module so that the lug on the snap lock clears the retaining edge of the module.

2 Push on the rear edge of the snap lock to move the snap lock through the slot toward the front of the module until it is clear.

To replace the snap lock:

1 Locate the snap lock into the slot on the bottom of the module.

2 Slide the snap lock toward the rear of the module until the lock snaps into position.

Plug-In Module Disassembly

Disassembly of the parameter module enables replacement of the front assembly.

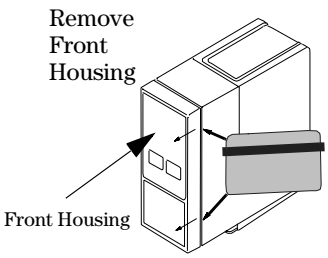


Figure 6 Removing the Module Front Housing

WARNING When you disassemble/assemble a plug-in module a patient leakage current test must be performed before it is used again for monitoring.

To disassemble a plug-in module:

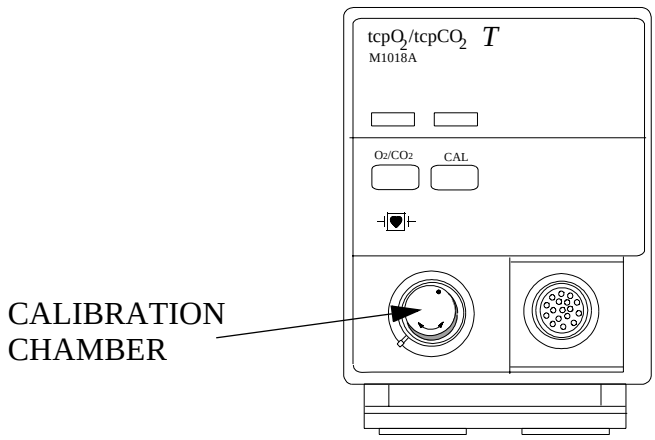
Remove the front housing.

- Place the module on a flat surface and insert a card (similar to a credit or cheque type card) into one side of the module to disengage the 2 tabs securing the front housing to the module housing.
- Pull the edge of the front housing away from the module housing.
- Carefully turn the module over so the free edge does not reengage and repeat the first two steps on the other side of the module. The front housing should now be free of the module housing.

To reassemble a plug-in module:

Snap-fit the front housing onto the front of the module case so the openings in the front housing match the LEDs and keys.

$tcpO_2/tcpCO_2$ Calibration Chamber Kit



To remove the calibration chamber

1 Using a flat-tipped screwdriver, remove the screw holding the calibration chamber in place on the front of the plug-in module.

2 Lift the chamber off the plug-in module. Ensure that the white plastic switch tip located in the module is not lost.

To replace the calibration chamber

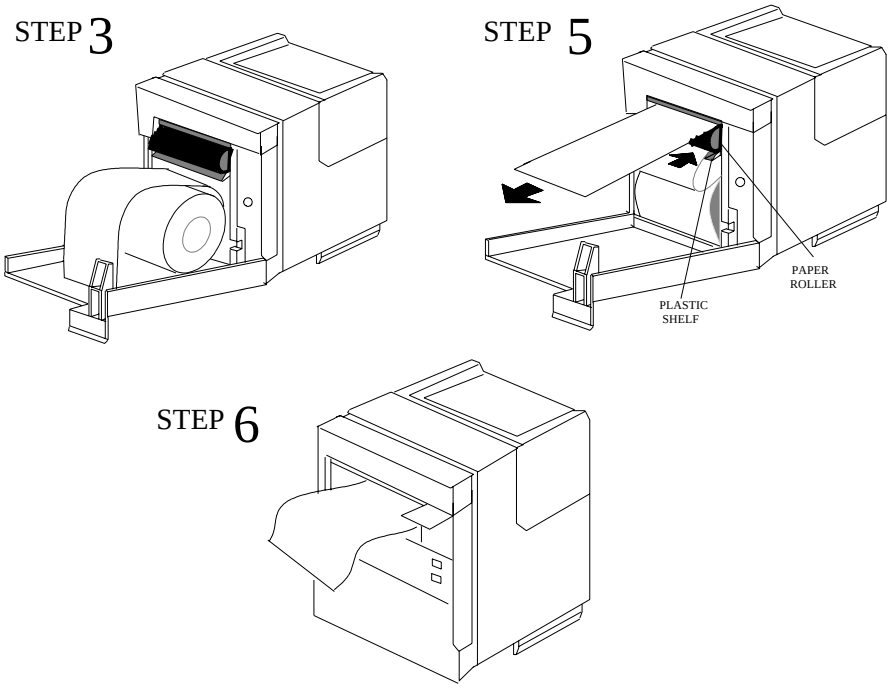
1 Ensure the white plastic switch tip is in place in the plug-in module.

2 Place the calibration chamber in the allocated position on the plug-in module.

3 Insert and tighten the screw into the calibration chamber, securing it to the plug-in module.

Recorder Module Paper

The recorder will not run when the door is open or when the recorder is out of paper. To prevent damage to the recorder module, use only Philips approved paper (Philips re-order number 40477A/B)



To load paper into the recorder module:

1 Remove the empty core from the previous roll of paper.

2 Cut off and discard the first few inches of paper to eliminate any traces of adhesive.

3 Pull out several inches of paper from the new roll, holding the roll with the loose end hanging over the top toward you.

4 Open the door and push the paper roll into the holders in the recorder.

5 Thread the paper under the roller and over the plastic shelf far enough so it goes around the roller and comes out above it.

6 Drape the paper over the end of the door and close the door. The paper should be visible and draped down in front of the door.

Disassembly Procedures for the Measurement Server Extension

It is recommended that you replace all the replaceable parts in the Extension (CO_2 Scrubber and Pump) after 15 000 hours (approximately 3 years) of continuous use.

Tools Required:

- A thin-bladed screwdriver.
- A pair of large tweezers.
- In addition, for removing the pump, you will need a large-bladed screwdriver.

WARNING There is high voltage inside the Instrument (800V). Do not connect the Measurement Server Extension to a Monitor while the Extension housing is open.

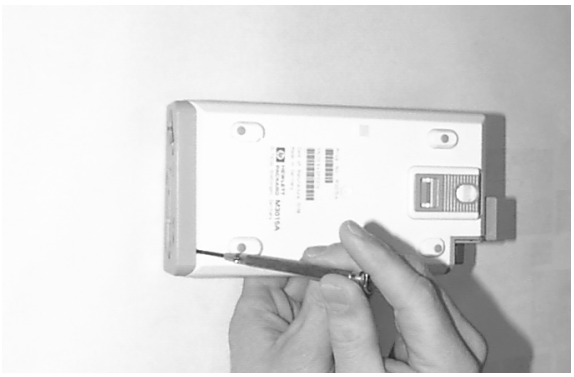
As well, parts inside the Instrument may be contaminated with bacteria. Protect yourself from possible infection by wearing examination gloves during these procedures.

Removing the Front Cover

To remove the front cover, do the following:

1 Remove the server and the monitor from the extension.

2 Use a thin-bladed screwdriver to prise the grey front cover (the console covering the measurement connector hardware) gently from the bottom of the extension. Position the screwdriver in the small slits provided for this purpose. The front cover then clicks away from the extension.



3 Remove the front cover.

Removing the Extension Bottom Cover

To remove the Extension bottom cover, do the following:

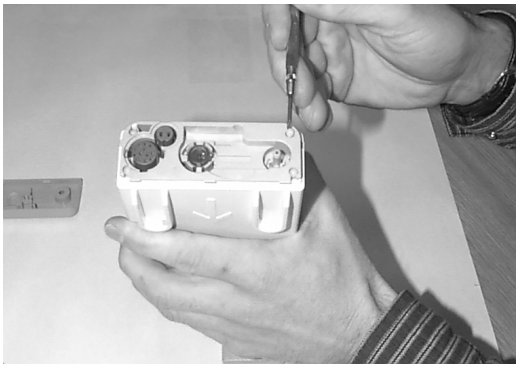
1 Position the extension on the dual link bar with the measurement connector hardware facing upwards and the arm of the dual link bar towards you. There are four long mounting pins threaded into the extension in each of the four corners under the cover. Locate the heads of the two long mounting pins on the side away from you

2 Use tweezers to prise the pins gently out enough to be removed by hand.

3 Remove the two pins and set them aside for refitting.

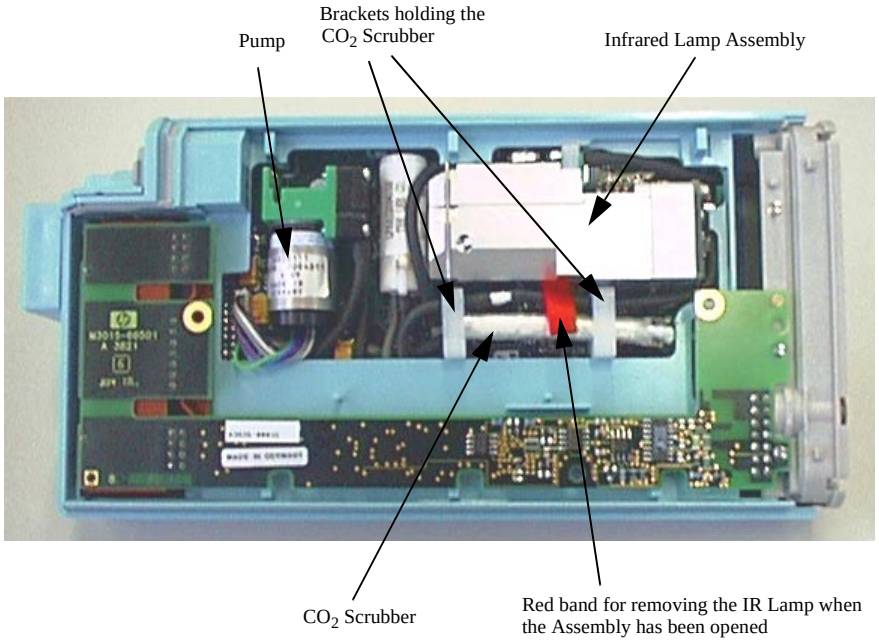
NOTE Do not lose these long mounting pins since the Extension will not function unless they are in place..

4 Using your hands, gently pry the bottom cover away from the Extension at the link bar end first. The bottom cover is press-latched at the link bar end. Remove it gently making sure not to bang or touch the inside of the Extension.



NOTE If you accidentally try to remove the wrong side of the bottom cover, you will notice that it is attached to the inside of the Extension with a ribbon connector and that the dual link bar prevents you from removing it completely. **Do not try to forcibly remove the wrong side of the M3015A cover; you cannot access replaceable parts from this side.**

The following illustration shows the location of the replaceable parts in the M3015A Measurement Server Extension.

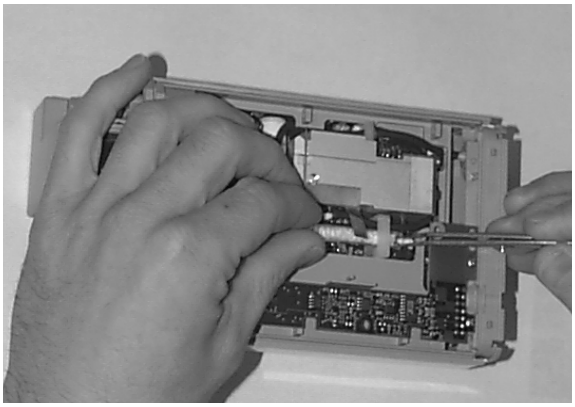


Removing the CO_2 Scrubber

To remove the CO_2 Scrubber, do the following:

1 Locate the CO_2 Scrubber in the Extension.

2 Being careful not to touch anything else in the Extension, use tweezers to pull the body of the CO_2 Scrubber out of the bracket.



3 Holding the body of the CO_2 Scrubber with your fingers, carefully disconnect the Extension intake tube from the scrubber end and remove the CO_2 Scrubber from the Extension.

4 Dispose of the CO_2 Scrubber according to local legal requirements for low volume chemical waste.

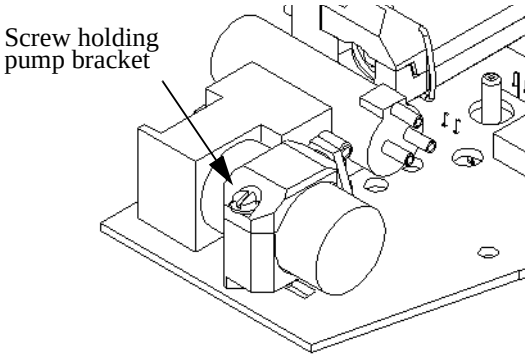
NOTE Now that it is exposed, do **NOT** allow anything to fall into the Infrared Lamp assembly.

Removing the Pump

To remove the Pump, do the following:

1 Locate the Pump in the Extension.

2 Being careful not to touch anything else in the Extension, unscrew the screw holding the pump bracket in position. Lift the top part of the bracket away and lift out the pump.



3 Gently disconnect the flow tubing attached to the Extension from the Pump.

NOTE Be sure to note which tube attaches to the inlet and which tube attaches to the outlet.

4 Gently disconnect the power lead which attaches the Pump to the Extension.

5 Remove the Pump.

NOTE After replacing the Pump, reset the displayed value displayed using the Reset PumpOpTime selection (Service Mode>CO_2 Setup). When the PumpOpTime has been reset an INOP will be generated: "CO_2 OCCLUSION". To clear this INOP you must perform a flow check and store the flow in Service Mode (select "Store Flow")

Refit Procedures for the Measurement Server Extension

Tools Required:

- A thin-bladed screwdriver.
- A pair of large tweezers.
- In addition, for refitting the Pump, you will need a large-bladed screwdriver.

WARNING There is high voltage inside the Instrument (800V). Do not connect the Measurement Server Extension to a Monitor while the Extension housing is open.

As well, parts inside the instrument may be contaminated with bacteria. protect yourself from possible infection by wearing examination gloves during these procedures.

Refitting the CO_2 Scrubber

WARNING The CO_2 Scrubber contains lithium hydroxide monohydrate. This is a strong base. Do not open or damage the CO_2 Scrubber. If you come into contact with the CO_2 Scrubber material, flush the area immediately with water and consult a doctor.

To refit the CO_2 Scrubber, do the following:

1 O_2 Scrubber through the bracket to meet the Extension intake tube.

2 Push the intake tube firmly into the scrubber end to connect it.

3 Holding the body of the CO_2 Scrubber with tweezers, feed the CO_2 Scrubber fresh air intake under the second bracket and position it.

Refitting the Pump

To refit the Pump, do the following:

1 Gently connect the power lead to the Extension.

NOTE The power lead can only be connected one way.Do not try to force the power lead into position. Instead, align it correctly and connect it gently.

2 Connect the flow tubing to the Pump.

NOTE Be sure to reconnect the inlet tube to the inlet valve and the outlet tube to the outlet valve.

1 Being careful not to touch anything else in the Extension, insert the pump into the bracket on the PC board. Make sure that the pump is horizontal and does not touch the PC board. (Vibration from the pump in operation will damage the Extension if the pump touches the PC board.)

2 Replace the top part of the bracket and screw firmly into position.

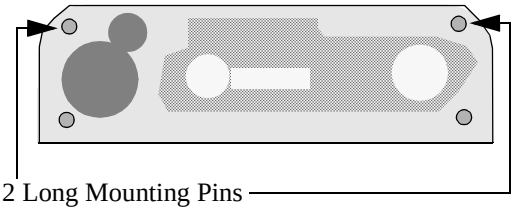
NOTE After replacing the Pump, reset the displayed value using the Reset PumpOpTime selection (Service Mode>CO_2 Setup). When the PumpOpTime has been reset an INOP will be generated: "CO_2 OCCLUSION". To clear this INOP you must perform a flow check and store the flow in Service Mode (select "Store Flow").

Refitting the Extension Bottom Cover

To refit the Extension bottom cover, do the following:

1 Latch the link bar end into place then press-click the bottom cover back into place covering the interior of the Extension.

2 Holding the bottom cover firmly in place, thread the two long mounting pins back into the Extension making sure to thread them all the way to the end.



Refitting the Front Cover

To refit the front cover, press-click it back into place over the measurement connector hardware.

General Reassembly/Refitting Comments

- Battery Door—When inserting the Monitor chassis, always open the battery compartment door to avoid striking the door clip.
- Ribbon Connections—Make sure male-female ribbon connections are correctly lined-up.
- Open Component—Do not allow anything to fall into the open component.

Following Reassembly

Once you have reassembled the Instrument, you must perform a safety and performance check on the Instrument. Refer to *Testing and Maintenance*.

6

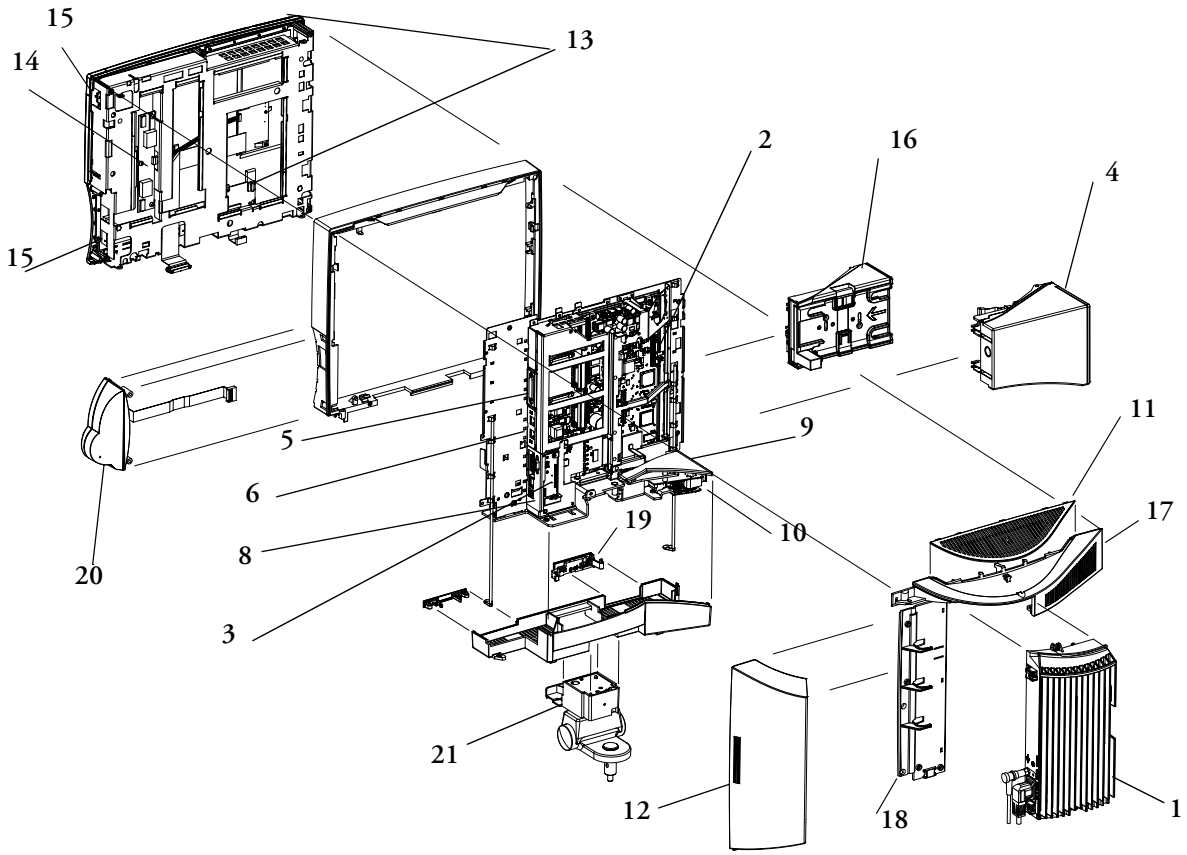
Parts

This section lists the replacement and exchange parts for the following Philips IntelliVue Patient Monitoring System components:

- MP60/MP70 Parts
- Flexible Module Server Parts
- Multi-Measurement Server Parts
- Measurement Server Extension Parts (M3015A and M3016A)
- Plug-in Modules Part Numbers
- External Display Part Numbers
- Remote Input Devices Part Numbers
- Remote Alarm Device Part Numbers
- Remote Extension Device Part Numbers

MP60/MP70 Parts

NOTE For part numbers of interconnecting cables, please consult the *Site Preparation* and *Installation Instructions* sections.



Exchange Parts

Exchange Part Number	New Part Number	Description	No. in Diagram
M4046-68001	M4046-60001	AC/DC Power Supply	1
M8050-68401	M8050-66401	Main Board 860/50 MHz	2
M8071-68011	M8071-67011	Video, Analog only, FPDL	3
M4046-68311	M4046-62311	Integrated Module Slot Assembly	4
M8081-68001	M8081-67001	I/F; Dual MIB	n/a
M8082-68001	M8082-67001	I/F; Centronics	5
M8086-68001	M8086-67001	I/F; HIF, Integral, PS/2	6
M8087-68001	M8087-67001	I/F; Flexible Alarm Relay	n/a
M8080-68001	M8080-67001	I/F; SRL/NGN Wireless-ready	8
M8080-68011	M8080-67011	I/F; SRL/NGN	8

Exchange Part Number	New Part Number	Description	No. in Diagram
M8085-68001	M8085-67001	I/F; ECG Out	9
M8064-68401	M8064-66401	Carrier SRL 2 (Side)	10

Replacement Parts

New Part Number	Description	No. in Diagram
M8065-66401	Carrier; Alarm LED	n/a
M8065-67041	Carrier; Power On LED	19
M4046-62201	Cover Rear Top	11
M4046-64105	Bezel Cover Rear Top	12
M4046-44101	Cover Rear Top	17
M4046-42301	Holder I/O Board Universal	18
M4046-67002	Touch Bezel Assembly with controller board	13
0950-4319	Backlight Inverter	14
2090-0890	Backlights	15
M4046-44103	Blank Cover Rear Middle	n/a
M4046-44104	Blank Cover Rear Bottom	n/a
M4046-61401	SpeedPoint	20
M4046-62301	MMS Mount Assembly	16
M4046-04111	Cover Blank/ I/O slots	n/a
M4046-62351	Mounting Assembly	21
M8000-64001	Small Parts Kit	

Flexible Module Server Parts

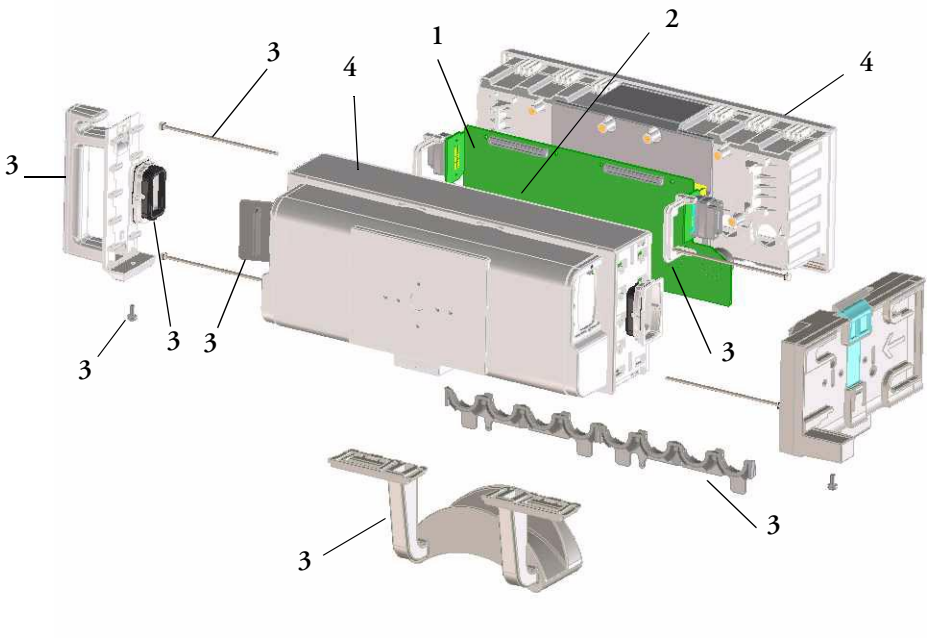


Figure 7 Flexible Module Server Parts

Exchange and Replacement Parts

Exchange Part Number	Replacement Parts	Description	No. in Diagram
M4041-68401		Mother board assembly	1
M8055-68401		CPU board assembly	2
	M8048-64002	Small Parts kit	3
	M8048-64001	Housing kit	4

Multi-Measurement Server Parts

The Multi-Measurement Server does not contain any servicable parts and can only be replaced in its entirety.

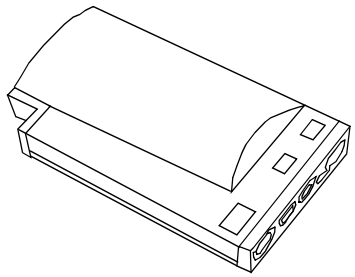


Figure 8 M3001A Multi-Measurement Server

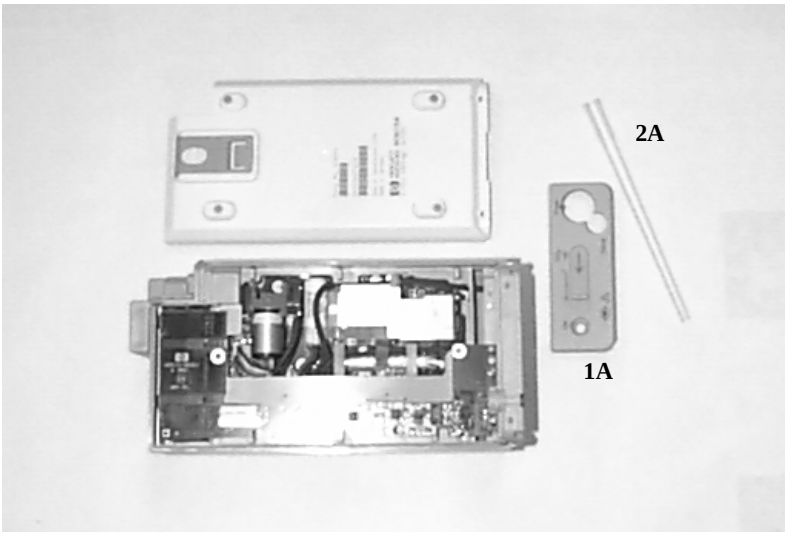
Multi-Measurement Servers are shipped with English front bezels only. If you require a bezel in another language (compare the part numbers of your language to the English ones to check this) the front bezel has to be ordered additionally. Attach the appropriate bezel before putting the MMS into operation.

Language		Basic	Pressure/ Temp Extension Option #C06	Conventional 12 Lead Option #C12	Conventional 12 Lead & Pressure/ Temp Extension Option #C18
English	Meas. Server	M3001-68101	M3001-68201	M3001-68301	M3001-68401
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101
French	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64102	M3001-44102	M3001-64102	M3001-44102
German	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64103	M3001-44103	M3001-64103	M3001-44103
Dutch	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64104	M3001-44104	M3001-64104	M3001-44104
Spanish	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64105	M3001-44105	M3001-64105	M3001-44105
Italian	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64106	M3001-44106	M3001-64106	M3001-44106
Norwegian	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64107	M3001-44107	M3001-64107	M3001-44107

Language		Basic	Pressure/ Temp Extension Option #C06	Conventional 12 Lead Option #C12	Conventional 12 Lead & Pressure/ Temp Extension Option #C18
Swedish	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64108	M3001-44108	M3001-64108	M3001-44108
Finnish	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64109	M3001-44109	M3001-64109	M3001-44109
Japanese	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101
Danish	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64111	M3001-44111	M3001-64111	M3001-44111
Traditional Chinese	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101
Simplified Chinese	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101
Portuguese	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64114	M3001-44114	M3001-64114	M3001-44114
Greek	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64115	M3001-44115	M3001-64115	M3001-44115
Turkish	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101
Russian	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64117	M3001-44117	M3001-64117	M3001-44117
Hungarian	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101
Czech	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64119	M3001-44119	M3001-64119	M3001-44119
Polish	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64120	M3001-44120	M3001-64120	M3001-44120
Slovak	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101
Korean	Meas. Server	M3001-68501	M3001-68601	M3001-68701	M3001-68801
	Front Bezel	M3001-64101	M3001-44101	M3001-64101	M3001-44101

Measurement Server Extension Parts (M3015A and M3016A)

The part numbers in the following parts table below, are used to order parts from your Philips representative. The item numbers correspond to the illustration which follows.



Part Number	Description	Item
M3015-44131	M3015A Front Bezel, English (also for French, Danish, Traditional Chinese and Simplified Chinese)	1A
M3015-44133	M3015A Front Bezel, German	Not Shown
M3015-44134	M3015A Front Bezel, Dutch	Not Shown
M3015-44135	M3015A Front Bezel, Spanish	Not Shown
M3015-44136	M3015A Front Bezel, Italian	Not Shown
M3015-44137	M3015A Front Bezel, Norwegian	Not Shown
M3015-44138	M3015A Front Bezel, Swedish	Not Shown
M3015-44139	M3015A Front Bezel, Finnish	Not Shown
M3015-44140	M3015A Front Bezel, Japanese	Not Shown
M3015-44144	M3015A Front Bezel, Portuguese	Not Shown
M3015-44145	M3015A Front Bezel, Greek	Not Shown
M3015-44147	M3015A Front Bezel, Russian	Not Shown
M3015-44150	M3015A Front Bezel, Polish	Not Shown
M3015-29314	M3015A Infrared Lamp Assembly (if previous version Infrared Lamp is required, please order an exchange Measurement Server Extension M3015-6801A)	Not Shown
M3015-29303	M3015A Pump Kit (including CO_2 scrubber)	Not Shown
5041-8114	Mounting Pin for M3015A	2A

Part Number	Description	Item
M3016-44131	M3016A Front Bezel, English (also for French, Danish, Traditional Chinese and Simplified Chinese)	Not Shown
M3016-44133	M3016A Front Bezel, German	Not Shown
M3016-44134	M3016A Front Bezel, Dutch	Not Shown
M3016-44135	M3016A Front Bezel, Spanish	Not Shown
M3016-44136	M3016A Front Bezel, Italian	Not Shown
M3016-44137	M3016A Front Bezel, Norwegian	Not Shown
M3016-44138	M3016A Front Bezel, Swedish	Not Shown
M3016-44139	M3016A Front Bezel, Finnish	Not Shown
M3016-44140	M3016A Front Bezel, Japanese	Not Shown
M3016-44144	M3016A Front Bezel, Portuguese	Not Shown
M3016-44145	M3016A Front Bezel, Greek	Not Shown
M3016-44147	M3016A Front Bezel, Russian	Not Shown
M3016-44150	M3016A Front Bezel, Polish	Not Shown

Exchange Parts List

Exchange parts are parts that have been returned to Philips and reconditioned for further use. Parts offered as exchange parts are in excellent service order according to rigorous PhilipsTechnologies standards but offer you a considerable price advantage.

Table 2 Exchange Parts Table.

Part Number	Description	Item
M3001-6801A	exchange Measurement Server, English (Rel. A)	Not Shown
M3001-6802A	exchange Measurement Server, French (Rel. A)	Not Shown
M3001-6803A	exchange Measurement Server, German (Rel. A)	Not Shown
M3001-6804A	exchange Measurement Server, Dutch (Rel. A)	Not Shown
M3001-6805A	exchange Measurement Server, Spanish (Rel. A)	Not Shown
M3001-6806A	exchange Measurement Server, Italian (Rel. A)	Not Shown
M3001-6807A	exchange Measurement Server, Norwegian (Rel. A)	Not Shown
M3001-6808A	exchange Measurement Server, Swedish (Rel. A)	Not Shown
M3001-6809A	exchange Measurement Server, Finnish (Rel. A)	Not Shown
M3001-6810A	exchange Measurement Server, Japanese (Rel. A)	Not Shown
M3001-6811A	exchange Measurement Server, Danish (Rel. A)	Not Shown
M3001-6812A	exchange Measurement Server, Traditional Chinese (Rel. A)	Not Shown
M3001-6813A	exchange Measurement Server, Simplified Chinese (Rel. A)	Not Shown
M3001-6814A	exchange Measurement Server, Portuguese (Rel. A)	Not Shown
M3001-6815A	exchange Measurement Server, Greek	Not Shown
M3001-6817A	exchange Measurement Server, Russian (Rel. A)	Not Shown
M3001-6820A	exchange Measurement Server, Polish (Rel. A)	Not Shown
M3015A-6801A	exchange M3015A Measurement Server Extension, English. For all languages apart from french, danish and chinese, order also the local language bezel as shown in the “List of Parts”.	Not Shown
M3016A-6801A	exchange M3016A Measurement Server Extension, English. For all languages apart from french, danish and chinese, order also the local language bezel as shown in the “List of Parts”.	Not Shown

Plug-in Modules Part Numbers

For inspection procedures; preventive maintenance procedures; cleaning procedures; and battery handling, maintenance, and good practices used to maintain the instrument in good working order, see *Testing and Maintenance*.

Part Number Table

The following table shows the part-numbers of the plug-in modules that can be replaced.
Find the right number for your language combining the P/N-Prefix with the language-specific suffix for the wanted module. For example, to order a TEMP module for the French language, the correct order number would be M1029-68801.

Exchange Modules, Table 1

Module#	Module Description	Part # Prefix	English	French	German	Dutch	Spanish	Italian	Norwegian	Swedish	Finnish	Japanese	Danish
M1001B	ECG	M1001-69	601	601	603	601	601	601	603	603	603	610	603
M1002B	ECG/Resp	M1002-69	601	601	603	601	601	601	603	603	603	610	603
M1006B	Inv. Press	M1006-69	601	601	603	604	605	601	607	608	609	610	611
M1006B #C01	Press with Analog Out	M1006-69	651	651	653	654	655	651	657	658	659	660	661
M1008B	NBP	M1008-69	601	602	601	604	605	606	607	608	601	610	601
M1012A	C.O.	M1012-69	601	602	603	601	605	601	601	601	601	610	601
M1012A #C10	C.O. with PiCCO extension	M1012-69	651	652	653	651	655	651	651	651	651	660	651
M1015A	CO2 Sidestream	M1015-69	601	601	601	601	601	601	601	601	601	610	601
M1016A	CO2 Mainstream	M1016-69	601	601	601	601	601	601	601	601	601	610	601
M1018A	tcpO2	M1018-69	601	602	601	601	601	601	601	601	601	610	601
M1020A	SpO2	M1020-69	601	601	601	601	605	605	601	605	601	610	601
M1021A	SvO2	M1021-69	601	601	601	601	601	601	601	601	601	601	601
M1027A	EEG	M1027-69	601	601	601	601	601	601	601	601	601	610	601
M1029A	Temp	M1029-69	601	601	601	601	601	601	601	601	609	610	601
M1032A #A01	VueLink Auxiliary	M1032-69	801	801	801	801	801	801	801	801	801	801	801
M1032A #A02	VueLink Ventilator	M1032-69	802	802	802	802	802	802	802	802	802	802	802
M1032A #A03	VueLink Gas Analyzer	M1032-69	803	803	803	803	803	803	803	803	803	803	803

Module#	Module Description	Part # Prefix	English	French	German	Dutch	Spanish	Italian	Norwegian	Swedish	Finnish	Japanese	Danish
M1032A #A04	VueLink Anesthesia Machine	M1032-69	804	804	804	804	804	804	804	804	804	804	804
M1032A #A05	VueLink Auxiliary Plus	M1032-69	805	805	805	805	805	805	805	805	805	805	805
M1034A	BIS	M1034-69	601	601	601	601	601	601	601	601	601	601	601
M1116B	Recorder	M1116-69	601	602	603	601	605	606	611	608	609	610	611
M1235A	Data Transfer	M1235-69	601	602	602	602	602	602	602	602	602	602	602
M3562A	Interface Module for Portal	M3562-69	601	601	601	601	601	601	601	601	601	601	601

Exchange Modules, Table 2

Module#	Module Description	Part # Prefix	Traditional Chinese	Simplified Chinese	Portuguese	Greek	Turkish	Russian	Hungarian	Czech	Polish	Slovak	Korean
M1001B	ECG	M1001-69	601	613	601	615	601	601	601	603	601	601	601
M1002B	ECG/Resp	M1002-69	601	613	601	615	601	601	601	619	620	601	601
M1006B	Inv. Press	M1006-69	601	613	614	615	601	601	601	619	620	601	601
M1006B #C01	Press with Analog Out	M1006-69	651	663	664	665	651	651	651	669	670	651	651
M1008B	NBP	M1008-69	601	613	614	615	601	601	601	601	620	601	601
M1012A	C.O.	M1012-69	601	613	602	615	601	601	601	601	601	601	601
M1012A #C10	C.O. with PiCCO extension	M1012-69	651	653	652	665	651	651	651	651	651	651	651
M1015A	CO2 Sidestream	M1015-69	601	613	601	601	601	601	601	601	601	601	601
M1016A	CO2 Mainstream	M1016-69	601	613	601	601	601	601	601	601	601	601	601
M1018A	tcpO2	M1018-69	601	613	614	601	601	601	601	601	601	601	601
M1020A	SpO2	M1020-69	601	613	605	615	601	601	601	601	620	601	601
M1021A	SvO2	M1021-69	601	613	601	601	601	601	601	601	601	601	601
M1027A	EEG	M1027-69	601	601	601	615	601	601	601	601	601	601	601

Module#	Module Description	Part # Prefix	Traditional Chinese	Simplified Chinese	Portuguese	Greek	Turkish	Russian	Hungarian	Czech	Polish	Slovak	Korean
M1029A	Temp	M1029-69	601	613	601	615	601	601	601	619	601	601	601
M1032A #A01	VueLink Auxiliary	M1032-69	801	801	801	801	801	801	801	801	801	801	801
M1032A #A02	VueLink Ventilator	M1032-69	802	802	802	802	802	802	802	802	802	802	802
M1032A #A03	VueLink Gas Analyzer	M1032-69	803	803	803	803	803	803	803	803	803	803	803
M1032A #A04	VueLink Anesthesia Machine	M1032-69	804	804	804	804	804	804	804	804	804	804	804
M1032A #A05	VueLink Auxiliary Plus	M1032-69	805	805	805	805	805	805	805	805	805	805	805
M1034A	BIS	M1034-69	601	601	601	601	601	601	601	601	601	601	601
M1116B	Recorder	M1116-69	601	613	614	615	601	601	601	619	620	601	601
M1235A	Data Transfer	M1235-69	602	602	602	602	601	602	601	602	602	601	601
M3562A	Interface Module for Portal	M3562-69	601	601	601	601	601	601	601	601	601	601	601

Plug-In Modules Replaceable Parts

The photographs below are examples of the parts listed in the Replaceable Parts table. Depending on the specific module the language and the color of the connector bezel may vary.

Single-Width Plug-In Module

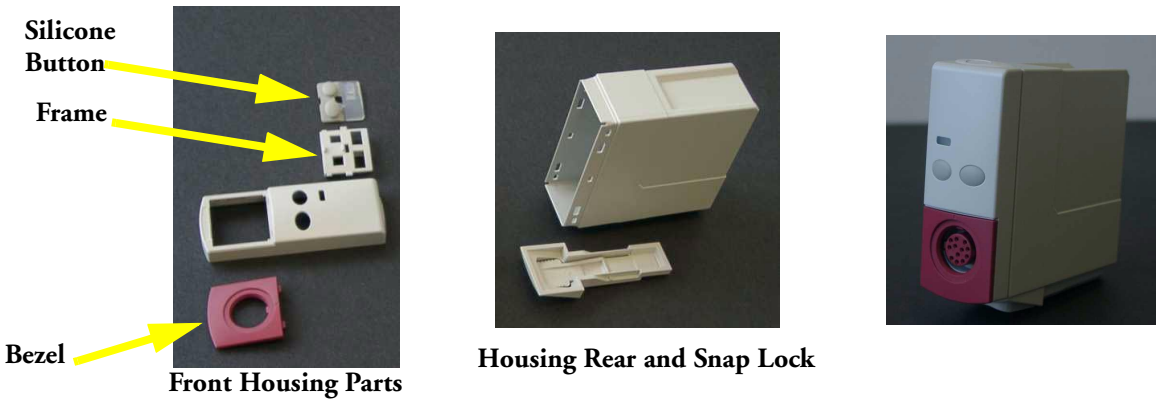


Figure 9 Single-Width Plug-In Module

Double-Width Plug-In Module

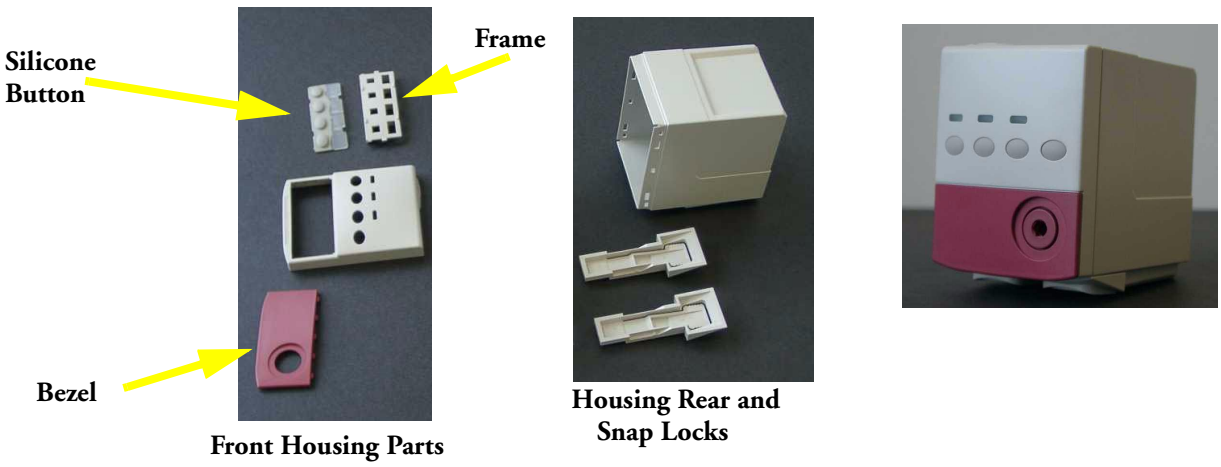


Figure 10 Double-width Plug-in Module

Plug-in Module Replaceable Parts

Part Number	Description
M1018-67911	$tcpO_2/CO_2$CALIBRATION CHAMBER KIT - New Color
M1027-61601	EEG MODULE TEST DEVICE
M1116-40041	TOP HOUSING (FITS M1116 *A* & M1116 *B* MODELS)
M1116-60201	M1116B RECORDER CLEANING KIT
M1001-64001	SILICONE BUTTON & FRAME PARTS KIT
M1001-45011	SNAP LOCK SINGLE

Plug-In Module Language Specific Front Housings, Table 1

Module#	Module Description	Part # Prefix	English	French	German	Dutch	Spanish	Italian	Norwegian	Swedish	Finnish	Japanese	Danish
M1001B	ECG	M1001-60	201	201	203	201	201	201	203	203	203	210	203
M1002B	ECG/Resp	M1002-60	201	201	203	201	201	201	203	203	203	210	203
M1006B	Inv. Press	M1006-60	201	201	203	204	205	201	207	208	209	210	211
M1006B #C01	Press with Analog Out	M1006-60	251	251	253	254	255	251	257	258	259	260	261
M1008B	NBP	M1008-60	201	202	201	204	205	206	207	208	201	210	201
M1012A	C.O.	M1012-60	201	202	203	201	205	201	201	201	201	210	201
M1012A #C10	CCO/C.O. with PiCCO functionality	M1012-60	251	252	253	251	255	251	251	251	251	260	251
M1015A	CO2 Sidestream	M1015-60	201	201	201	201	201	201	201	201	201	210	201
M1016A	CO2 Mainstream	M1016-60	201	201	201	201	201	201	201	201	201	210	201
M1018A	tcpO2	M1018-60	201	202	201	201	201	201	201	201	201	210	201
M1020A	SpO2	M1020-60	201	201	201	201	205	205	201	205	201	210	201
M1021A	SvO2	M1021-60	201	201	201	201	201	201	201	201	201	201	201
M1027A	EEG	M1027-60	201	201	201	201	201	201	201	201	201	210	201
M1029A	Temp	M1029-60	201	201	201	201	201	201	201	201	209	210	201
M1032A	VueLink all Types	M1032-60	201	201	201	201	201	201	201	201	201	201	201
M1034A	BIS	M1034-60	201	201	201	201	201	201	201	201	201	201	201
M1116B	Recorder	M1116-60	201	202	203	201	205	206	211	208	209	210	211
M1235A	Data Transfer	M1235-60	201	202	202	202	202	202	202	202	202	202	202
M3562A	Interface Module for Portal	M3562-60	201	201	201	201	201	201	201	201	201	201	201

Plug-In Module Language Specific Front Housings, Table 2

Module#	Module Description	Part # Prefix	Traditional Chinese	Simplified Chinese	Portuguese	Greek	Turkish	Russian	Hungarian	Czech	Polish	Slovak	Korean
M1001B	ECG	M1001-60	201	213	201	215	201	201	201	203	201	201	201
M1002B	ECG/Resp	M1002-60	201	213	201	215	201	201	201	219	220	201	201
M1006B	Inv. Press	M1006-60	201	213	214	215	201	201	201	219	220	201	201
M1006B #C01	Press with Analog Out	M1006-60	251	263	264	265	251	251	251	269	270	251	251
M1008B	NBP	M1008-60	201	213	214	215	201	201	201	201	220	201	201
M1012A	C.O.	M1012-60	201	213	202	215	201	201	201	201	201	201	201
M1012A #C10	CCO/C.O. with PiCCO functionality	M1012-60	251	263	252	265	251	251	251	251	251	251	251
M1015A	CO2 Sidestream	M1015-60	201	213	201	201	201	201	201	201	201	201	201
M1016A	CO2 Mainstream	M1016-60	201	213	201	201	201	201	201	201	201	201	201
M1018A	tcpO2	M1018-60	201	213	214	201	201	201	201	201	201	201	201
M1020A	SpO2	M1020-60	201	213	205	215	201	201	201	201	220	201	201
M1021A	SvO2	M1021-60	201	213	201	201	201	201	201	201	201	201	201
M1027A	EEG	M1027-60	201	201	201	215	201	201	201	201	201	201	201
M1029A	Temp	M1029-60	201	213	201	215	201	201	201	219	201	201	201
M1032A	VueLink all Types	M1032-60	201	201	201	201	201	201	201	201	201	201	201
M1034A	BIS	M1034-60	201	201	201	201	201	201	201	201	201	201	201
M1116B	Recorder	M1116-60	201	213	214	215	201	201	201	219	220	201	201
M1235A	Data Transfer	M1235-60	202	202	202	202	201	202	201	202	202	201	201
M3562A	Interface Module for Portal	M3562-60	201	201	201	201	201	201	201	201	201	201	201

Plug-In Module Specific Bezels

Module#	Module Description	Bezel Part#
M1001B	ECG	M1001-42201
M1002B	ECG/Resp	M1001-42201
M1006B	Inv. Press	M1006-42202
M1008B	NBP	M1008-42201
M1012A	C.O.	M1012-42201
M1016A	CO2 Mainstream	M1016-42201
M1018A	tcpO2	M1018-42201
M1020A	SpO2	M1020-42201
M1021A	SvO2	M1021-42201
M1027A	EEG	M1027-42201
M1029A	Temp	M1029-42201
M1032A	VueLink	M1032-42201
M1034A	BIS	M1034-42201
M1235A	Data Transfer	M1001-42221
M3562A	Interface Module for Portal	M3560-42201

BIS Module Replaceable Parts

Part Number	Description	
M1034-61630	BIS PIC (PATIENT INTERFACE CABLE)	14
M1034-61650	BIS SENSOR SIMULATOR	
M1034-68520	BIS ENGINE	12
M1034-xxxxx	BIS DSC-XP	13
M1034-61610	BIS MODULE CABLE (0.8 m)	11
M1034-61620	BIS MODULE CABLE (2.0 m)	11

BIS Module Components

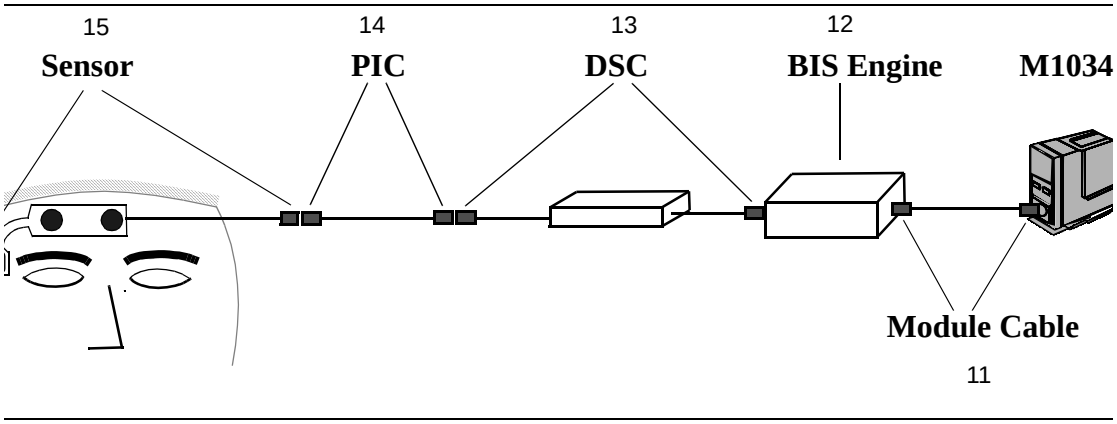


Figure 11 BIS Module Components

$tcpO_2/tcpCO_2$ Module Accessories

The following accessories can be ordered for the $tcpO_2/tcpCO_2$ Module:

Table 3 $tcpO_2/tcpCO_2$ Monitoring Accessories

New Part Number	Description
M15209-60010	Accessory Kit
M15210-60010	CAL 1 gas (6 bottles - U.S.A. only)
M15210-64010	CAL 1 gas (6 bottles)
M15210-60020	CAL 2 gas (6 bottles - U.S.A. only) Contains: 0% O_2, 10% CO_2
M15210-64020	CAL 2 gas (6 bottles) Contains: 0% O_2, 10% CO_2
M1918A	$tcpO_2/CO_2$ Transducer
M2205A	Calibration Tubing (5x)

External Display Part Numbers

Figure 12 External XGA Display

Table 4 External XGA Display Parts

Product Option	Part Number	Description
M1097A #A02	M1097-60004	15” Dual Mode XGA Color Touch Screen Display. SN > TW412....
	M1097-60002	15” XGA Color Touch Screen Display. SN < TW412....
	M1097-68004	Exchange 15” Dual Mode XGA Color Touch Screen Display. Order for displays with SN > TW412....
	M1097-68002	Exchange 15” XGA Color Touch Screen Display. Order for displays with SN < TW412....
	M1097-68001	Exchange 15” XGA Color Non-Touch Display. Order for non-touch displays.
M1181A #A78	M1181-61695	3m XGA Video Cable with right-angled connector. Computer module to M1097A display.
M1181A #A79	M1181-61698	10m XGA Video Cable with right-angled connector. Computer module to M1097A.
	M1097-64001	Power Supply Mounting Clamp for M1097A.
	M1097-01201	Mounting Bracket for M1097A.
	M1097-60005	Power Supply.
Dual Mode M1097A Touch Screen Display (SN > TW412...)		
	M1097-61604	Adapter Cable.
	M1097-04702	Desk Stand for M1097A Display.
Single Mode Touch (SN < 412...) and Non-Touch Sereen Display M1097A		
	M1097-04701	Desk Stand for M1097A Display.

Remote Input Devices Part Numbers

The SpeedPoint Device contains no servicable parts and can only be replaced in its entirety.

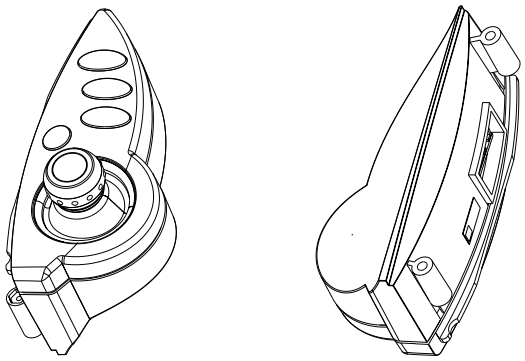


Figure 13 SpeedPoint Input Device M4046-61401

Remote Alarm Device Part Numbers

The Remote Alarm Device contains no servicable parts and can only be replaced in its entirety (exchange part number: M8025-68001). For cable part numbers please see the Site Preparation chapter.

Figure 14 Remote Alarm Device Front and Rear View

Remote Extension Device Part Numbers

The Remote Extension Device contains no servicable parts and can only be replaced in its entirety (exchange part number: M8026-68001).

Figure 15 Remote Extension Device Front and Rear View

7

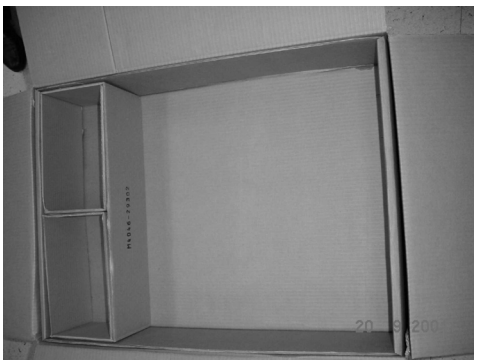
Installation Instructions

The information contained in this chapter should enable the MP60/MP70 to be installed ready for use (the preparation and planning should be adhered to as specified in the *Site Preparation* section. Safety checks and inspection procedures for mounts are explained in the *Testing and Maintenance* Section and configuration of the system is explained in the Configuration Guide.

Unpacking the Equipment

Your equipment will arrive in a carton similar to the ones pictured below. All components of the monitoring system are consolidated into a single packing crate. The contents of this crate depend on the options you have purchased. In addition to the monitor it can contain the following:

- MMS and user manuals
- FMS
- Parameter modules
- Measurement server extensions and accessories



Accessory Packaging

Monitor Packaging

Figure 16 Accessory and Monitor Packaging

In the unlikely event of a defect on arrival, please keep the packing materials until you have completed the initial inspection.

Initial Inspection

Mechanical Inspection

Open the shipping container(s) and examine each part of the instrument for visible damage, such as broken connectors or controls, or scratches on the equipment surfaces. If the shipping carton/container is undamaged, check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. This may be necessary to support claims for hidden damage that may only become apparent during subsequent testing.

Electrical Inspection

The instrument has undergone extensive testing prior to shipment. It is not required, but it is recommended that you perform the patient safety checks before the instrument is used for patient monitoring. An extensive self check may also be performed. This recommendation does not supercede local requirements.

All tests are described in the *Testing and Maintenance* section of this manual.

Claims For Damage and Repackaging

Claims for Damage

When the equipment is received, if physical damage is evident or if the monitor does not meet the specified operational requirements of the patient safety checks or the extended self check, notify the carrier and the nearest Philips Sales/Support Office at once. Philips will arrange for immediate repair or replacement of the instrument without waiting for the claim settlement by the carrier.

Repackaging for Shipment or Storage

If the instrument is to be shipped to a Philips Sales/Support Office, securely attach a label showing the name and address of the owner, the instrument model and serial numbers, and the repair required (or symptoms of the fault). If available and reusable, the original Philips packaging should be used to provide adequate protection during transit. If the original Philips packaging is not available or reusable please contact the Philips Sales/Support Office who will provide information about adequate packaging materials and methods.

Installing the Monitor (M8005A or M8007A)

NOTE There are different mounting options available for the monitor. This section covers the general concepts of safe mount installations and specific steps for the mounting options sold by Philips. Instructions which ship with a mounting solution should always take precedence over the instructions described in this chapter.

You MUST follow the instructions that ship with the mounting solution, regardless of manufacturer.

Mounting Instructions

Assembling Mounts

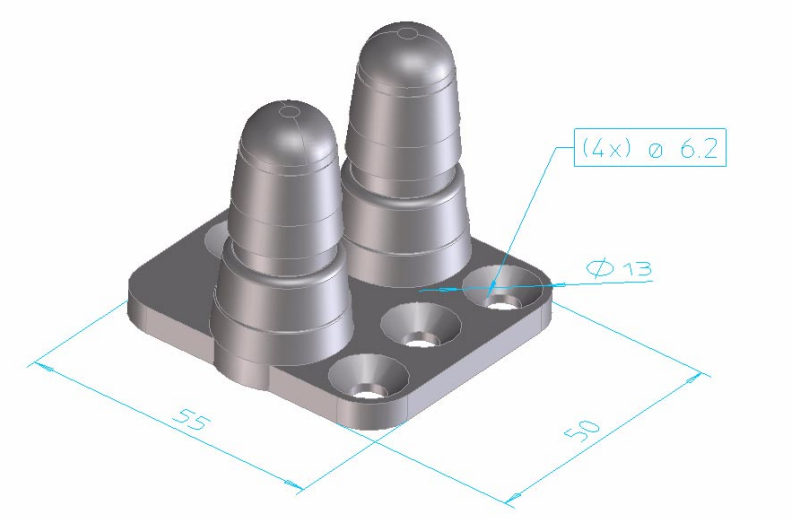


Figure 17 Table Mount

The table mount ships with the monitor. Every type of compatible mounting solution is delivered with a complete set of mounting hardware and instructions. Refer to the documentation delivered with the mounting hardware for instructions on assembling mounts.

WARNING It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.

Ensure that this commitment has been met before assembling mounts.

Connections

The following figure is a side view of the monitor, and shows the cable and interface board connections.

All molded connector cables on the monitor side attach at the location shown in the figure. The device may have a second MSL port on the same side as the power switch near the ECG out location (not shown in this figure).

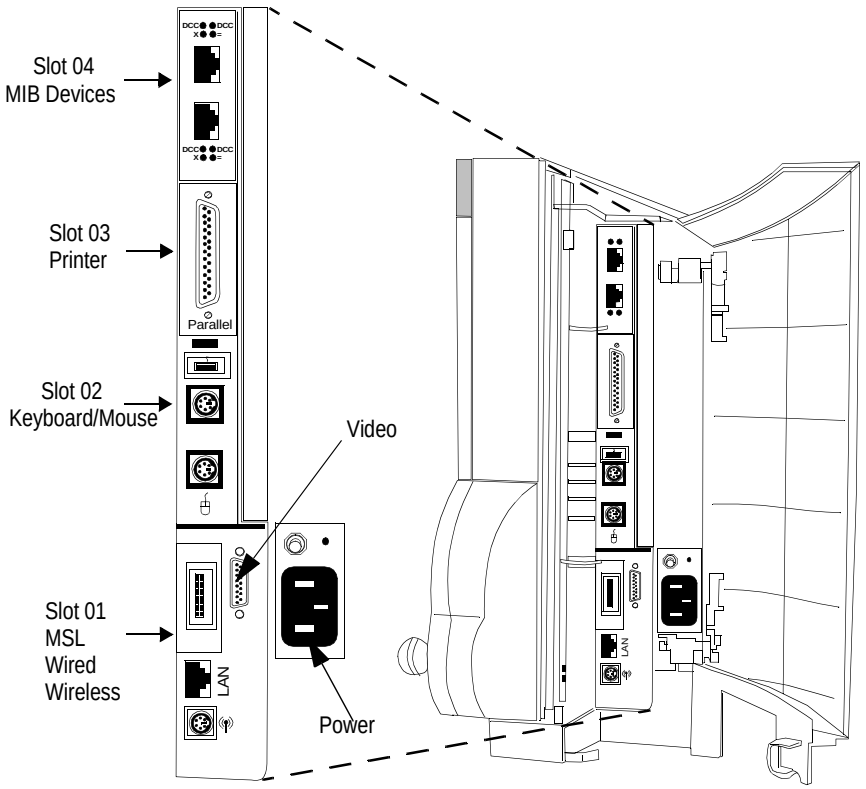


Figure 18 MP60/MP70 Cable and Interface Board Connections

Installing Interface Boards

If you add interface boards to your monitor, you must insert them into the device according to the combinations in the following table:

I/O Board		Possible Configurations								
Name	**Compatibility Rules**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
MSL/LAN	Must be in slot 01	01	01	01	01	01	01	01	01	01
PS/2 Device Interface	Must be in slot 02 if used for the integrated Speed Point	02	02	02	02	02	02	-	-	-
Remote Device Interface	Must be in slot 03 if supporting the Remote Alarm Device	03	03	03	-	-	-	03	03	-
Parallel Printer Interface	Preferred slot 03	04	-	-	03	03	-	02	02	03
Nurse Call Relay (Flexible)	Must be in slots 02, 03, or 04	X	04	-	04	-	04	04	-	02
MIB/RS232	Preferred slot is 04	X	X	04	X	04	X	X	04	04

"-" This board is assumed to not be required for the configuration

"X" This board cannot be assigned in this configuration

Installing Remote Devices

This section provides instructions for Philips products. Installation instructions for devices not sold by Philips must be provided by the device manufacturer.

Mounting the Remote Display (M8031A)

The Philips M8031A XGA Color Flatscreen Display is designed for use with the MP60/MP70 monitor as a slave display. A bracket is supplied with the display to connect it to a variety of Philips mounting devices.

A - Removing the desktop stand:

1 Remove the covers from the screws on the back of the flatscreen display

2 Remove the four screws from the back cover of the display and detach the cover.

3 Remove the four screws from the desktop stand and detach the desktop stand.

B - Attaching the bracket:

1 Place the bracket on the back of the display with the slits facing upwards.

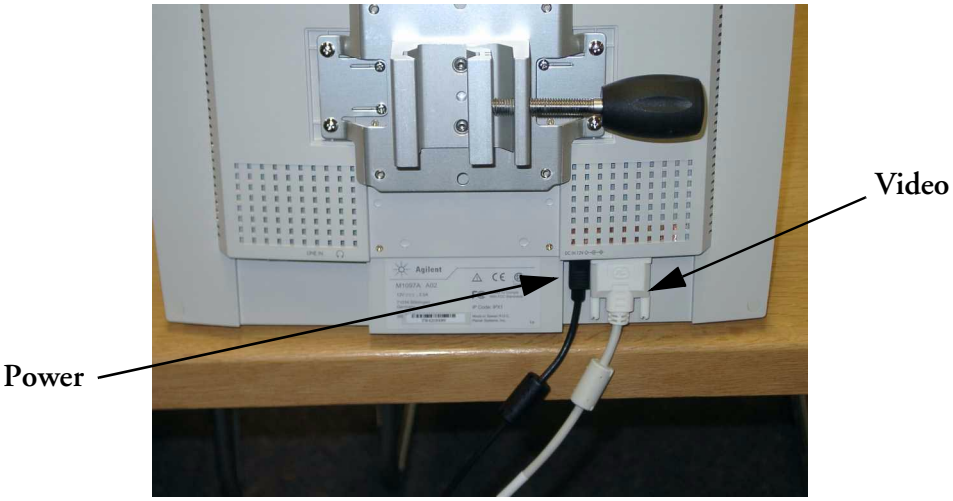
2 Attach the bracket to the display with four M4x8 screws.

3 Attach the desired mounting device to bracket.

NOTE Do not mount the display in a position where liquid could spill onto it.

Connections

Connect the cables to the display as shown in the photograph.



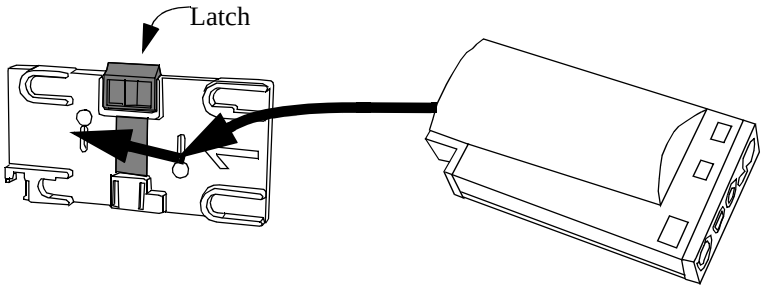
Flexible Module Server and/or Multi-Measurement Server

Attaching the MMS to a Mount

1 Make sure the Measurement Server is oriented correctly relative to the mount (see the picture below).

2 Place the Measurement Server on the back mount. If it is not tight against the mount, slip it in the direction of the measurement connectors until it is.

3 Slip the Measurement Server forward until it clicks into place.



Detaching the Measurement Server from a Mount

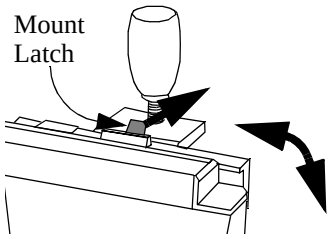
1 Press and hold the latch (in the middle at the top of the mount) away from the Measurement Server.

2 Slide the Measurement Server off the mount in the direction of the measurement connectors.

Positioning the Measurement Server on a Clamp Mount

If you have your Measurement Server on the clamp mount, you can have it in one of four positions. You can reposition it as follows:

1 Press and hold the mount latch toward the clamp screw.



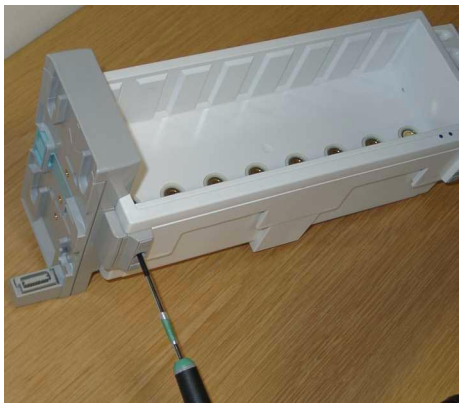
Rotate the Measurement Server and mount until you get it to the position you want.

2 Release the mount latch, and make sure it is clicked into one of the four slots on the back of the mount.

Mounting the MMS Mount to the FMS (M8048A)

1 Connect the MMS Mount to the FMS and snap it into place.

2 Insert and tighten the screw at the bottom of the FMS



Mounting the Remote Extension Device to the FMS

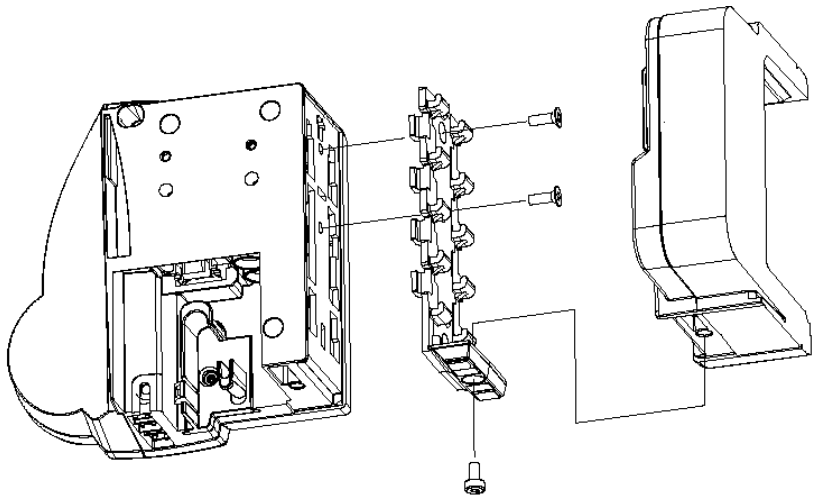


Figure 19 Mounting the Remote Extension Box to M8048A Flexible Module Server

Mounting the BIS Module to the FMS

1 Remove the existing handle for the FMS, see Figure 20.

2 Attach the bracket to the FMS using a M4 x 8mm PHMS, see Figure 21.

3 Attach the BIS engine onto the mount, see Figure 22.

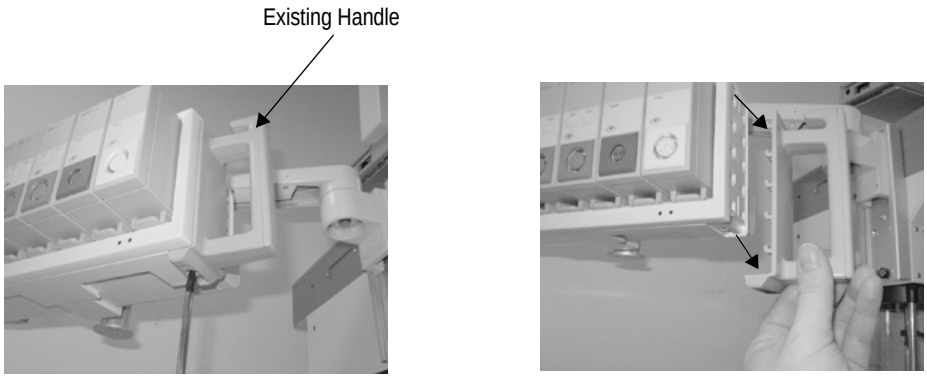


Figure 20 Removing the FMS Handle

Figure 21 Attaching the Philips - BIS Flexible Measurement Server Mount

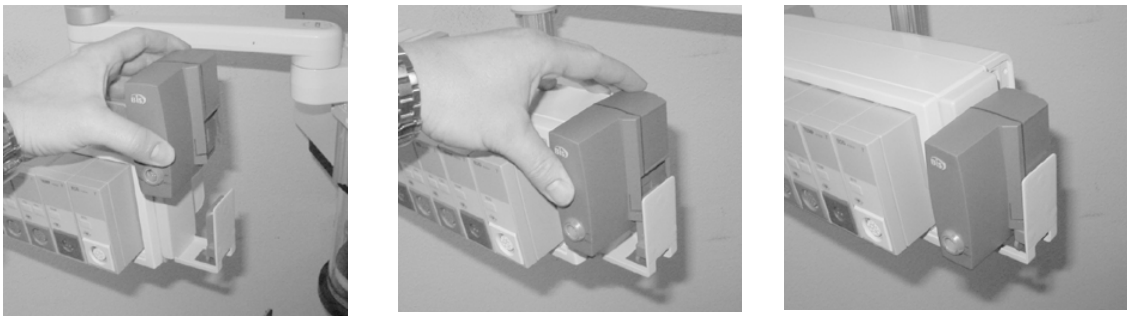
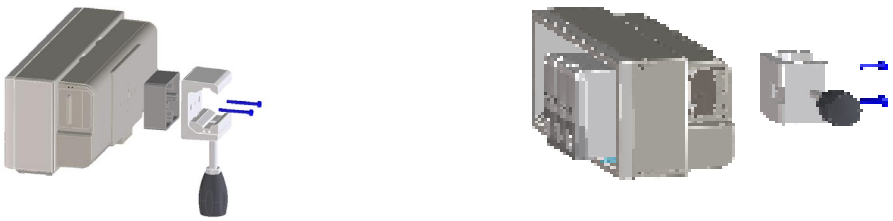


Figure 22 Attaching the BIS Engine to Mount

Mounting the FMS

A universal clamp for vertical rail or pole solutions ships with each FMS.



Connections

The cable specifications and part numbers for through wall solutions of the M8048A and M3001A are described in the *Site Preparation* section of this manual.

MSL Cable Termination

The following installation procedure describes how to install the wall installation cable kit when the patient monitor and the measurement server are not located at the same site. The kit consists of two connector boxes and a cable (15m or 25m).

For this procedure you need the insertion tool (M3086-43801) and a small screwdriver.

1 Draw the MSL cable through the wall from the site of the monitor to the site of the measurement server.
Each MSL face plate kit contains two connector boxes; one in-going and one out-going. (The US version contains an additional rectangular wall-mounting plate).

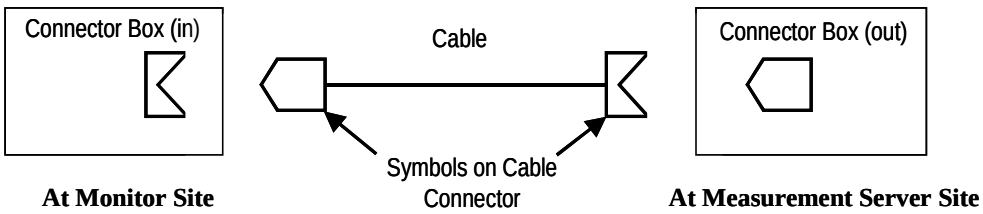
NOTE The installation procedure is the same for both connector boxes. This means you must perform steps 3 to 8 of this procedure twice.

The connectors on each box are different, so you must ensure that the correct box is placed at the correct location. The symbol on the plastic angled cover indicates at which site you should install the box:

Symbol: is connector box (in) and must be placed at the monitor site.

Symbol: is connector box (out) and must be placed at the measurement server site.

The correct connector cable (M3081-60601, M3081-60602 or M3081-60603) has the opposite symbol:



If there are no symbols on the cover, dots are used:

• ⇔ •• and • ⇔ •

2 Detach the PCB assembly (in/out) from the metallic mounting flange.

3 Use the Insertion Tool (M3086-43801) to position each wire on the PCB according the wiring schematic in Figure 23, where each color corresponds to a number.

NOTE The Insertion Tool should be set to cutting mode &= on.

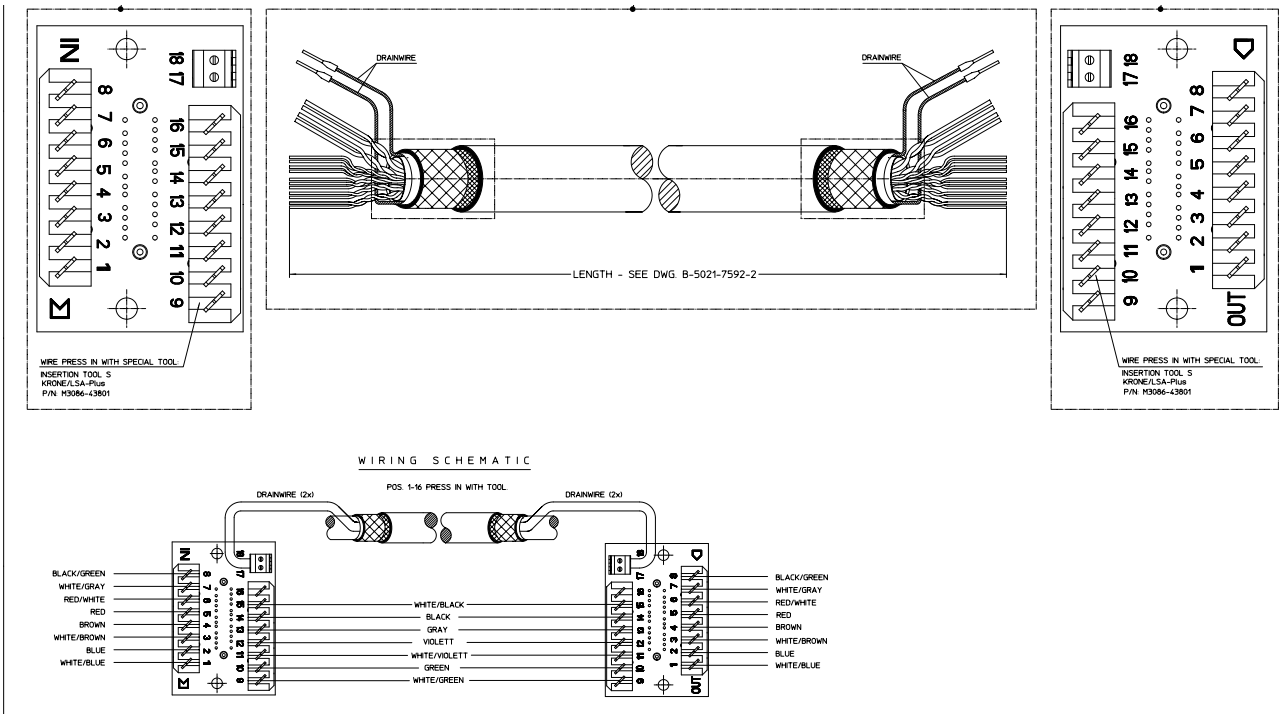


Figure 23 Connections for BIS Module

4 Use a small screwdriver to connect the two drain wires to the PCB, see the wiring schematic in Figure 23.

5 Slide the PCB back on to the metallic mounting flange.

6 Use screws to fasten the mounting flange to the wall.

NOTE US version only: Fasten the rectangular wall-mounting plate to the wall. Attach the mounting flange to the wall-mounting plate.

7 Mount the plastic cover. The plastic cover consists of two pieces:

– Frame

– Angled cover

Put the frame over the mounting insert and the PCB. Place the angled cover on top and fasten with two screws.

8 Connect the monitor and the measurement server to the wall installation.

9 Perform the following tests as described in the Test and Maintenance section of this manual:

– Power-on test blocks

– Safety test blocks

– ECG Sync Performance Test

Remote Alarm Devices

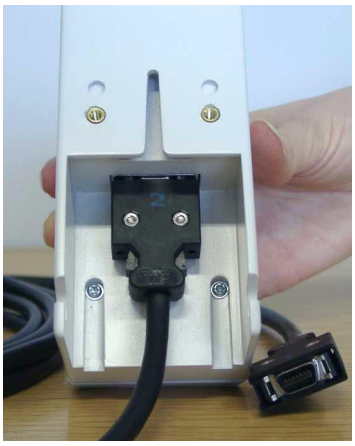
Mounting

The mounting devices for the Remote Alarm Device are the same as for the Remote Extension Device. See *Remote Extension Device* for details.

Connections

Remote Alarm Device Rear View

Remote Alarm Device Connector



Remote Alarm Device with Cable connected

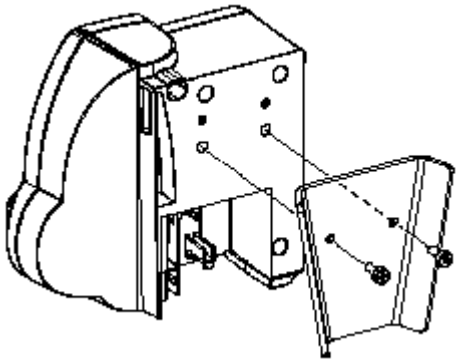
Figure 24 Remote Alarm Device Connector

Remote Extension Device

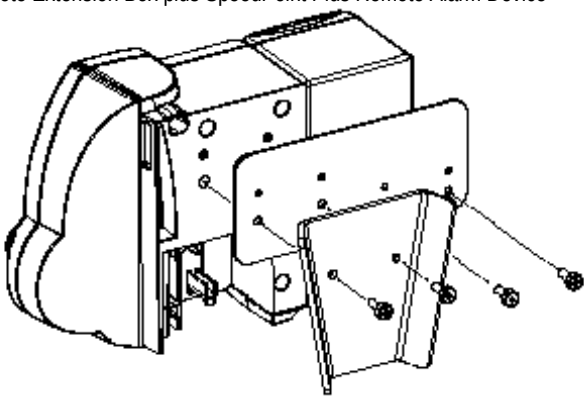
Mounting

Mounting solutions for the Remote Extension Device are pictured below. Use 3.5 x 35mm screws to attach the mounts to the wall.

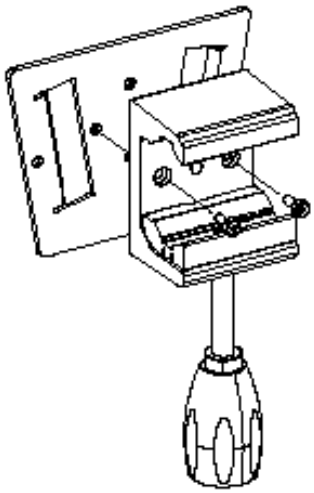
Remote Extension Box plus SpeedPoint



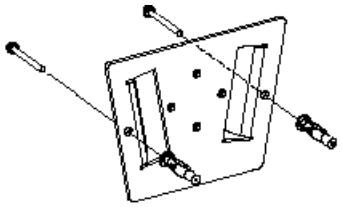
Remote Extension Box plus SpeedPoint Plus Remote Alarm Device



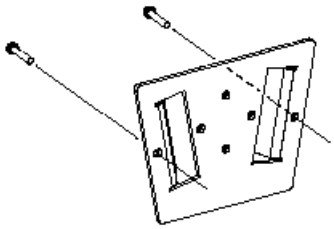
Clamp Wall plus Clamp Universal



Clamp Wall plus Universal Fixings (Concrete Wall)



Clamp Wall plus Screws (Plywood Wall)



Connections

Connect the cable to the Remote Extension Device as shown in the photograph.

Remote Extension Device Rear View

Remote Extension Device Connectors

Remote Extension Device with Cable connected

Figure 25 Remote Extension Device Connections

Cabling

The connection at the monitor should look like on the photograph . Connect the cable at both the extension device and the monitor

Philips Clinical Network

Refer to the installation instructions in the M3185A Installation Manual.

Flexible Nurse Call Relay

Connections

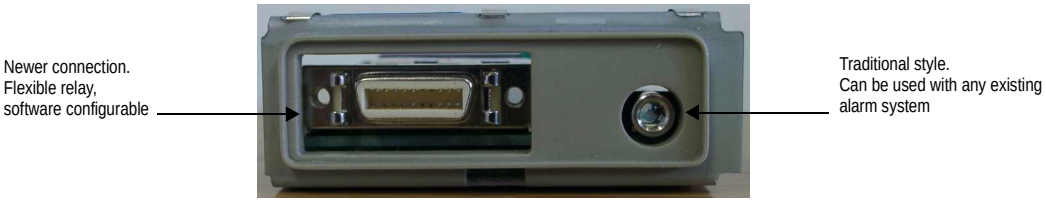
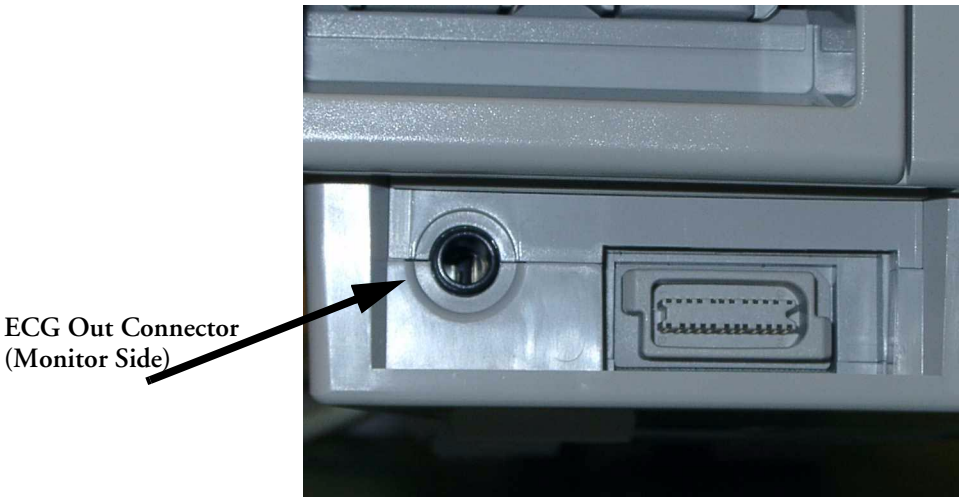


Figure 26 Flexible Nurse Call Relay Connections at Monitor

ECG Out Functionality

Connections

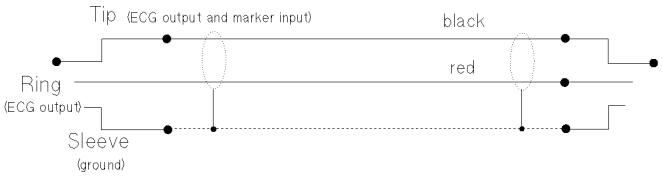


The cable M1181A #A62 has both ends terminated. The photograph above shows the monitor side connection.

If using a non-terminated cable:

1 Strip 5 mm (3/16") insulation from leads and twist conductor strands tightly.

2 Solder leads to the connector as shown in the following diagram.


Tip (ECG output and marker input)
black
red
Ring
(ECG output)
Sleeve
(ground)

Configuration Tasks

You must configure these settings during installation in configuration mode.

- Line Frequency
- Printer
- Altitude
- Equipment Label (for wireless networked monitors, or when the Information center is in flexible monitoring mode).

Setting Altitude, Line Frequency and Barometric Pressure

You require a local barometric pressure rating from a reliable source (such as airport, regional weather station, or hospital weather station) that is located at the same altitude as the institution.

1 From the **Main Setup** menu, select **Global Setting**. Select **Altitude** and enter the altitude.

2 From the **Main Setup** menu, select **Global Setting**. Select **Line Frequency** and choose the Line Frequency.

3 From the **Main Setup** menu, select **Monitor**. Select **Barometric Pressure** and enter the pressure.

Configuring the Equipment Label

If the Information Center is in fixed monitoring mode, it controls the equipment label. You do not need to follow this procedure.

However, if you are on a wireless network, or your Information Center is configured for flexible monitoring mode, you must set the equipment label. This associates the monitor with a central monitoring sector. An identical monitor label must also be configured in the Information Center.

1 Select the **Bed Label** screen element to call up the **Bed Info** menu.

2 Select **Equipment Label** to call up the onscreen keyboard.

3 Enter the system identifier. This needs to be set up in either the monitor or the information Center. If the Information Center is in flexible monitoring mode, the monitor must be setup to match the Information Center's monitor label.

8

Site Preparation

Introduction

This section describes the procedures you should follow to plan and prepare a site for an MP60/MP70 monitor installation. It describes:

- Site planning.
- Roles and responsibilities for local and Philips personnel.
- Remote installation planning.

Site Planning

The careful planning of the site for the MP60/MP70 monitor is essential for its safe and efficient operation. A consulting schedule should be established between the Customer and Philips Sales and Support Representatives, to ensure that all preparations are completed when the system is delivered.

The site planning phases prior to equipment installation are:

Location: Planning the location of the various system components.

Environment: Confirming and correcting, as necessary, the environment of the proposed installation site(s).

System Capabilities: Explaining the possibilities for system expansion.

Mounting: Referencing the mounting hardware information website for the listing of suitable mounting hardware recommended for use with the various system components, and all details on the available mounts and accessories.

Cabling: Identifying the requirements for the cabling, conduiting and faceplates for connecting the various system components.

Roles & Responsibilities

This section describes the procedures necessary to prepare a site for a system installation. The procedures are grouped into two parts: procedures that local staff or contractors are responsible for, and procedures that Philips personnel are responsible for.

Site Preparation Responsibilities

Local Staff

- Ensure that all safety, environmental and power requirements are met.
- Provide power outlets.

- Prepare mounts.
- Pull cables, install conduit, install wallboxes.
- Terminate network cables if a Philips Clinical Network is in use.
- It may be necessary to certify the network cable plant, see Philips Clinical Network Installation Manual for details.

Philips Personnel

- Provide the customer with the safety, environmental and power requirements.
- Assemble mounts.
- Prepare monitor remote cabling.

Procedures for Local Staff

The following tasks must be completed **before** the procedures for Philips personnel may be started.

Providing Power Outlets

One power outlet for each display and for any peripheral device (for example, a printer or slave display) is required by the system. Provide a power outlet in the vicinity (1 m or 3 ft) of each component that requires power.

WARNING Only the power cables provided with the system may be used. For reasons of safety, the use of power (mains) extension cables or adapters is NOT recommended.

Preparing Mounts

Where ceiling, wall, or shelf mounts are required for mounting the equipment, the customer is responsible for the following:

- Providing and installing all hardware which is required to install the mounting hardware supplied by Philips as detailed in the installation notes.
- Making sure that all ceilings, walls, and mounting rails that supports mounting hardware are suitable for their proposed load.

WARNING It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.

Although considerable effort has been made to ensure the safety of the ceiling mount installation and or mounting guidelines, it is to be understood that the installation itself is beyond the control of Philips Medical Systems. Accordingly, Philips Medical Systems will not be responsible for the failure of any such installation.

The following figures show the dimensions required for the M1180A #C53 wall and the table mounting bracket which ships with the monitor.

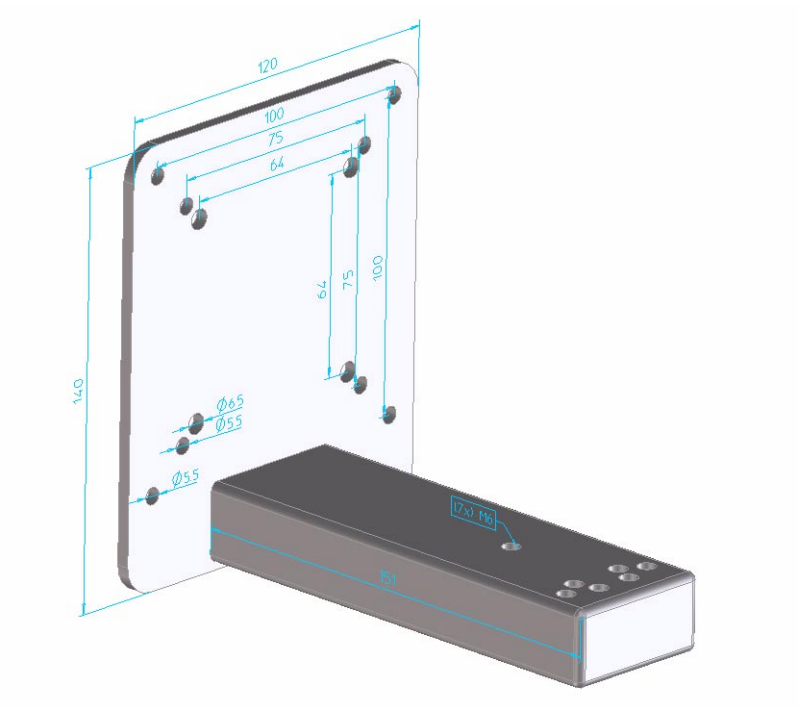


Figure 27 Wall Mounting Bracket Dimensions

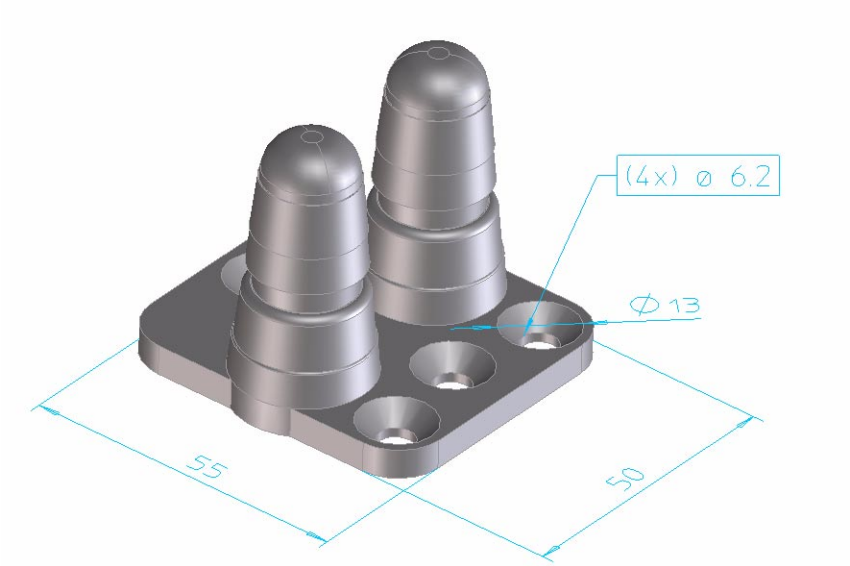


Figure 28 Table Mounting Bracket Dimensions

Providing Conduit

Where a remote installation is required, for example the installation of a remote display, the customer is responsible for the following hardware installations:

- Providing conduit and/or trunking of a sufficient cross-sectional area for the planned cables and possible future expansion (for additional components or systems). See *Cabling Options and Conduit Size Requirements* for cable specifications for remote installations.
- Providing and/or installing suitable wall boxes to accommodate the faceplates.

Pulling Cables

WARNING NEVER run power cables through the same conduit or trunking used for system cables.

Installing Wall Boxes

It is the customer's responsibility to provide and install wallboxes to house faceplates. The customer must notify the Philips installation coordinator of which size is to be used.

Procedures for Philips Personnel

Before you begin the procedures in the installation sections, ensure that the customer has completed all necessary preparations outlined in the previous section, "Procedures for Local Staff."

Monitor M8005A and M8007A Site Requirements

Space Requirements

The situating of the monitor should be planned such that the nursing staff are able to monitor the patient with relative ease, with all patient connectors and controls readily available and the displays clearly visible. The location should also allow access to service personnel without excessive disruption and should have sufficient clearance all round to allow air circulation.

Maximum dimensions and weight:

Size (W x H x D)

405mm x 360mm x 170mm (15.95” x 14.17” x 6.69”)
without handle and Speedpoint device

Weight

10kg (22.05lb) without options

Environmental Requirements

The environment where the MP60/MP70 monitor will be used should be reasonably free from vibration, dust and corrosive or explosive gases. The ambient operating and storage conditions for the MP60/MP70 monitor must be observed. If these conditions are not met, the accuracy of the system will be affected and damage can occur.

Temperature

Operating: 0 to 35°C (32 to 95°F)

Storage: -20 to 60°C (-4 to 140°F)

Humidity

Operating: 20% to 85% Relative Humidity (RH) (non-condensing)

Storage: 5% to 85% Relative Humidity (RH)

Altitude

Operating: 0m to 3000m (10000 ft.)

Storage: 0m to 12000m (40000 ft.)

Electrical and Safety Requirements (Customer or Philips)

Safety Requirements

If the MP60/MP70 monitor is to be used in internal examinations on the heart or brain ensure that the monitor is connected to an equipotential grounding system.

Grounding

The MP60/MP70 monitor **MUST** be grounded during operation (Class I equipment according to IEC 60601-1). If a three-wire receptacle is not available then the hospital electrician must be consulted to ensure that proper grounding is available on installation. **NEVER** attempt to use a three-wire to two-wire adapter with the MP60/MP70 monitor.

WARNING Each component must be individually grounded for safety and interference suppression purposes.

Electrical Requirements

Line Voltage Connection

The MP60/MP70 monitor uses < 145 W (1.6 to 0.7 A).

Line Voltage

The MP60/MP70 monitor may be operated on ac line voltage ranges of 100 to 240V (50/60 Hz).

Remote Device Site Requirements

The system can be installed with one or more combinations of the following remote devices.

Flexible Module Server or Multi-Measurement Server

Remote Display

Remote Alarm Device

Remote Extension Device (with or without SpeedPoint)

Where more than one site is used for locating equipment (a remote installation), the following sections should be considered for EACH device:

- Space Requirements
- Environmental Requirements

- Mounting
- Electrical and Safety Requirements
- Cabling Options and Conduit Size Requirements

Connecting Non-Medical Devices

The standard IEC-60601-1-1 applies to any combination of medical and non-medical devices, where at least one is a medical device.

WARNING Do not use an external device in the patient vicinity if it is not isolated. External devices in the patient vicinity must be powered from an isolation transformer and not directly from the mains power supply.

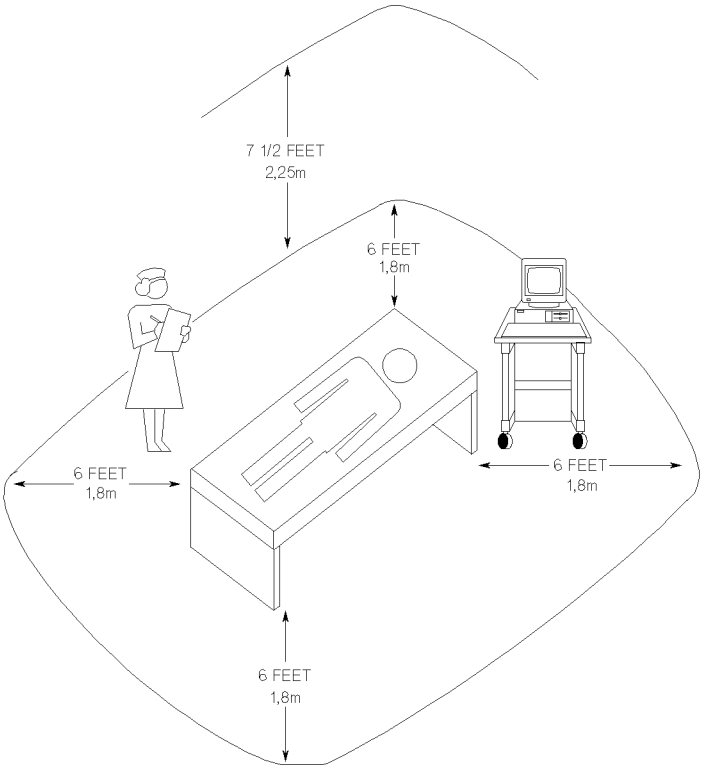


Figure 29 Equipment Location in the Patient Vicinity

NOTE The site planning requirements, with the exception of the cabling, must be provided by the device manufacturer, if the remote device is not purchased from Philips.

Multi-Measurement Server M3001A or Flexible Module Server M8048A

Space Requirements Multi-Measurement Server M3001A

Size (W x D x H)

188.0mm x 96.5 mm x 51.5 mm

(7.40” x 3.80” x 2.03”)

Weight

650g (1.4 lb)

Space Requirements Flexible Module Server M8048A

Size (W x D x H)

320 mm x 120mm x 35mm (12.6” x 4.72” x 5.3”)

Weight

< 3500g (7.7lb)

Environmental Requirements Multi-Measurement Server M3001A

Temperature

Operating: 0 to 45°C (32 to 113°F)

Storage: -40 to 70°C (-40 to 158°F)

Humidity

Operating: 95% relative humidity (RH) max. @ 40°C (104°F)

Storage: 90% relative humidity (RH) max. @ 65°C (150°F)

Altitude

Operating: -500m to 4600m (-1600 to 15000 ft.)

Storage: -500m to 15300m (-1600 to 50000 ft.)

Environmental Requirements Flexible Module Server M8048A

Temperature

Operating: 0 to 45°C (32 to 113°F)

Storage: -40 to 70°C (-40 to 158°F)

Humidity

Operating: 95% relative humidity (RH) max. @ 40°C (104°F)

Storage: 90% relative humidity (RH) max. @ 65°C (150°F)

Altitude

Operating: -500m to 4600m (-1600 to 15000 ft.)

Storage: -500m to 15300m (-1600 to 50000 ft.)

Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the FMS and the MMS.

Table 5 M8048A and M3001A Cables

Product Option Number	Part Number	Description	Conduit Sizes	Max. Bend Angle
Both ends are terminated with straight SRL connectors.				
M8022A #SC1	M3081-61626	0.75m Measurement Server to Monitor	not yet available.	not yet available.
M8022A #SC2	M3081-61602	2m Measurement Server to Monitor		
M8022A #SC4	M3081-61603	4m Measurement Server to Monitor		
M8022A #SC6	M3081-61627	10m Measurement Server to Monitor[a]		
M8022A #SC7	M3081-61628	15m Measurement Server to Monitor[a]		
M8022A #SC9	M3081-61629	25m Measurement Server to Monitor[a]		
Unterminated Cables				
M3081A #A15	M3081-61615	MSL Installation Cable 15m		
M3081A #A15	M3081-61625	MSL Installation Cable 25m		
	M3081-68708	MSL Face Plate US version (pair of connector boxes)		
	M3081-68707	MSL Face Plate non-US version (pair of connector boxes)		
[a]Built on demand..				

Table 6 M8048A Flexible Module Server Mounts

Product Option Number	Part Number	Description
M8022A #E15	tbd	Cable Management
M8022A #E20	tbd	MMS Mount
	tbd	Handle

Remote Displays (M8031A)

Space Requirements

Size (W x D x H)

With mounting bracket: 333mm x 408mm x 85mm (13.1” x 16” x 3.4”)

With desk stand: 387mm x 408mm x 175mm (15.2” x 16” x 6.9”)

Weight

With mounting bracket: 4900g (10.8lb)

With desk stand: 6900g (15.2lb)

Environmental Requirements

Temperature

Operating: 5 to 45°C (41 to 113°F

Storage: -20 to 60°C (-4 to 140°F)

Humidity

Operating: 95% RH max @ 40°C (104°F)

Storage: 85% RH max @ 50°C (122°F)

Altitude

Operating: Up to 4600m (15000 ft.)

Storage: Up to 4600m (15000 ft.)

Electrical and Safety Requirements

Voltage ranges:

90V to 264V (13.5A fuse)

Voltage selection:

Wide range input, no voltage selection required

Power consumption:

Maximum ?

Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the M8031A 15” TFT Medical Grade Touch Display.

Table 7 M8031A 15” TFT Touch Display Cables

Product Option Number	Part Number	Description	Conduit Sizes	Max. Bend Angle
M8022 #VA2	M3080-61606	1.5m Analogue Video Cable Kit	not yet available.	not yet available.
M8022 #VA3	M3080-61602	3m Analogue Video Cable Kit		
M8022 #VA6	M3080-61603	10m Analogue Video Cable Kit[a]		
M8022 #VA7	M3080-61607	15m Analogue Video Cable Kit[a]		
M8022 #VA9	M3080-61608	25m Analogue Video Cable Kit[a]		
Both ends are terminated with HDSUB15 (“VGA”) connectors [a]Built on demand				

The following table describes the cabling options for the M8039A Remote Display.

Table 8 M8039A 21” Remote Display Cables

Product Option Number	Part Number	Description	Conduit Sizes	Max. Bend Angle
M8022A #K02	tbd	1.5m Cable Kit	not yet available.	not yet available.
M8022A #K03	tbd	3m Cable Kit		
M8022A #K06	tbd	10m Cable Kit.		

Remote Alarm Devices

Space Requirements

Size (W x D x H)

62mm x 125mm x 63 mm (2.4” x 5” x 2.5”)

Weight

< 300 g (< 0.7 lb)

Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the Remote Alarm Device M8025A.

Table 9 M8025A Remote Alarm Device Cables

Product Option Number	Part Number	Description	Conduit	Max. Bend Angle
M8022A #HF2	M8086-61003	1.5m Monitor to Remote Device	not yet available.	not yet available.
M8022A #HF3	M8086-61004	3m Monitor to Remote Device		
M8022A #HF6	M8086-61005	10m Monitor to Remote Device[a]		
M8022A #HF7	M8086-61006	15m Monitor to Remote Device[a]		
M8022A #HF9	M8086-61007	25m Monitor to Remote Device[a]		
Both ends are terminated with straight MDR connectors. [a]Built on demand.				

Remote Extension Device

Space Requirements

Size (W x D x H):

103mm x 139mm x 63 mm (4” x 5.5” x 2.5”)

Weight:

< 400 g (< 0.9 lb)

Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the M8026A Remote Extension Device.

Table 10 M8026A Remote Input Extension Device Cables

Product Option Number	Part Number	Description	Conduit	Max. Bend Angle
M8022A #HF2	M8086-61003	1.5m Monitor to Remote Device	not yet available.	not yet available.
M8022A #HF3	M8086-61004	3m Monitor to Remote Device		
M8022A #HF6	M8086-61005	10m Monitor to Remote Device[a]		
M8022A #HF7	M8086-61006	15m Monitor to Remote Device[a]		
M8022A #HF9	M8086-61007	25m Monitor to Remote Device[a]		
Both ends are terminated with straight MDR connectors. [a]Built on demand.				

Input Devices

The following tables describes the input devices which can be connected to the Remote Extension Device M8024A, or directly to the MP60/MP70 monitor.

Table 11 M8024A Input Devices

Product Option Number	Part Number	Description
Mouse		
M8022A #B01	tbd	Wired Mouse
M8022A #B02	tbd	Wireless Mouse
Trackball		
M8022A #C01	tbd	Wired Trackball
M8022A #C02	tbd	Wireless Trackball

Local Printer

See printer documentation

Philips Medical LAN

For information refer to the Philips Information Center documentation.

MIB Interface

Table 12 MIB Cable (“Yellow” LAN Cable) and Serial Cable (“Gray” LAN Cable)

Product Option Number	Part Number	Description	Conduit Sizes	Max. Bend Angle
M8022A #SR2	M8081-61001	1.5m including adapter set.	not yet available.	not yet available.
M8022A #SR3	M8081-61002	3m including adapter set.		
M8022A #SR6	M8081-61003	10m including adapter set[a].		
M8022A #SR7	M8081-61004	15m including adapter set[a]		
M8022A #SR9	M8081-61005	25m including adapter set[a]		
Both ends are terminated with 8 pin RJ45 connectors. CAT5 cable; straight through wiring. [a]Built on demand				

Table 13 Wireless LAN Adapter Cable

Product Option Number	Part Number	Description	Conduit Sizes	Max. Bend Angle
M8022A #WL0	M8080-61001	~30cm Y-piece; DC supply plus LAN	not yet available.	not yet available.

Flexible Nurse Call Relay Interface

Table 14 Nurse Paging Cable

Product Option Number	Part Number	Description	Conduit Sizes	Max. Bend Angle
M8022A #AR3	M1181-61648	3m standard nurse paging relay cable. One end terminated with phone plug, one end without connector.	not yet available.	not yet available.
M8022A #AR6	M8087-61001	10m flexible nurse paging cable. One end terminated with straight MDR connector, one end without connector.		

ECG Out Interface

Table 15 ECG Out Cable

Product Option Number	Part Number	Description	Conduit Sizes	Max. Bend Angle
M8022A #A62	8120-1022	3m	not yet available.	not yet available.
Both ends are terminated with .25” phone plugs				

9

Anesthetic Gas Module

Introduction

This chapter contains the following information on the M1026A Anesthesia Gas Module:

- A description of the Module, including its physical, environmental and performance specifications
- A general explanation of the measurement principles that the Module uses to measure gas concentrations
- The theory of operation of the Module: the layout of its components and how they work.

Description

The Philips M1026A Anesthetic Gas Module works together with the IntelliVue MP60 and MP70 patient monitors through an RS232 serial interface. It measures the airway gases of ventilated patients who are under general gas anesthesia, or emerging from it.

The module produces graphical wave data, and inspired and end-tidal numeric data for the following gases:

- CO_2
- N_2O
- One volatile anesthetic agent
- O_2 (optional)

It also generates numerics for the patient's airway respiration rate (AWRR).

The Agent Identification feature identifies which anesthetic agent is being used.

Product Structure

The only version of the M1026A Anesthetic Gas Module compatible with the IntelliVue Monitoring System is:

M1026A #A05: M1026A Watertrap with 5-Agent-ID (Hal, Iso, Enf, Des, Sev)

- #C03 (MUST-Option): adds fast O_2 measurement

Physical Specifications

Size (H x W x D)

90mm x 370mm x 467mm (3.54 x 14.6 x 18.4 in).

Weight

8.2 kg (18 lb).

Environmental Specifications

Operating Temperature

15 to 40°C (59 to 104°F).

Storage Temperature

-40 to 65°C (-40 to 149°F).

Humidity Limit (Operating)

up to 95% RH max @ 40 °C (104 °F).
non-condensing

Humidity Limit (Storage)

up to 95% RH max @ 65 °C (149 °F).
non-condensing

Altitude Range (Operating)

-305 to 3048m (-1,000 to 10,000 ft).

Altitude Range (Storage)

-305 to 5,486m (-1,000 to 18,000 ft).

Warm-up Time

After switching on: 2 minutes to measure, 8 minutes for full specification accuracy.

Performance Specifications

All Performance and accuracy specifications are valid based on gas sample tubing M1658A, including watertrap M1657B, and airway adapter 13902A.

Humidity Correction: For CO_2 the humidity correction can be set to “wet” or “dry”.

Wet: p [mmHg] = c [Vol%] * (p_abs - p_H_2O)/100

Dry: p [mmHg] = c [Vol%] * p_abs /100

Where p = partial pressure, c = gas concentration, p_abs = pressure in breathing circuit, p_H_2O = 47 mmHg, partial pressure of water vapor of exhaled gas (37 ^oC, 100% rh).

For all other gases the readings are always given as dry values.

Sample Flow Rate*:* 150 ml/min.

Sample Delay Time: All measurements and alarms are subject to a delay of 3 seconds.

Total System Response Time = the sum of the delay time and the rise time.

CO_2 Measurement

Range:	0 to 76 mmHg
Accuracy:	1.5 mmHg (0 - 40 mmHg) 2.5 mmHg (40 - 60 mmHg) 4.0 mmHg (60 - 76 mmHg)
Resolution:	1 mmHg
Rise-time:	410 msec typical

The total system response time is the sum of the sample delay time (3 seconds) and the rise time (410 msec typical)

AWRR derived from CO_2 Waveform

Range:	0 to 60 rpm
Accuracy:	± 2 rpm
Resolution:	1 rpm
Detection Criteria:	6 mmHg variation in CO_2

N_2O Measurement

Range:	0 to 85 vol%
Accuracy:	1.5 vol% + 5% relative
Resolution:	1 vol%
Rise-time:	510 msec typical

O_2 Measurement

Range:	0 to 100vol%
Accuracy:	± 2.5 vol% or 5% relative, whichever is the greater.
Resolution:	1 vol%
Rise-time:	450 msec typical

Agent	Range (vol%)	Accuracy	Resolution	Rise Time
Halothane	0 - 7.5	0.2 vol% + 4.0% relative	0.05	< 740
Enflurane	0 - 7.5	0.1 vol% + 4.0% relative	0.05	< 620
Isoflurane	0 - 7.5	0.1 vol% + 4.0% relative	0.05	< 610
Sevoflurane	0 - 9.0	0.1 vol% + 4.0% relative	0.05	< 570
Desflurane	0 - 20.0	0.1 vol% + 6.0% relative	0.05 (0-10) 0.1 (10.1-20)	< 540

Agent	High Range	Low Range
AWRR	**10 - 60 rpm**	**0 - 59 rpm**
$ETCO_2$	**20 - 76 mmHg**	**10 - 75 mmHg**
$IMCO_2$	**2 - 20 mmHg**	**none**
inN_2O	**0 - 82 vol%**	**none**
inO_2	**19-100 vol%**	**18 - 99 vol%**
et SEV	**0.1 - 9.0 vol%**	**0.0 - 8.9 vol%**
in SEV	**0.1 - 9.0 vol%**	**0.0 - 8.9 vol%**
et DES	**0.2 - 20.0 vol%**	**0.0 - 19.8 vol%**
in DES	**0.2 - 20.0 vol%**	**0.0 - 19.8 vol%**
Halogthane, Enflurane, Isoflurane		
et	**0.1 - 7.5 vol%**	**0.0 - 7.4 vol%**
in	**0.1 - 7.5 vol%**	**0.0 - 7.4 vol%**

Alarm Delay:

10 seconds if no automatic zero calibration occurs within that time.

Apnea Alarm:

Delay Range:	10 - 40 seconds
Criterion	No detected breath within the adjusted delay time
Alarm:	Within 2 seconds after this criterion is met, if no automatic zero occurs

INOP Alarms

INOP alarms are triggered if:

- The Philips M1026A Anesthetic Gas Module is disconnected or switched off.
- The equipment malfunctions.
- The Agent-ID malfunctions.
- Zero calibration has failed.
- Zero calibration is in progress.
- The gas sample tube is occluded, or the water trap is full.
- The Philips M1026A Anesthetic Gas Module is unable to measure.
- Gas contaminant is detected.
- Agent mixture detected.
- Anesthetic agent detected but not selected.
- The module is in warm-up mode.
- No breath detected.
- The Anesthetic Gas Module is incompatible with the monitor

General Measurement Principles

The Philips M1026A Anesthetic Gas Module uses a technique called *Non-Dispersive Infrared Gas Concentration Measurement* (NDIR) to measure the concentration of gases.

This works as follows:

- The gases that the Philips M1026A Anesthetic Gas Module can measure absorb infrared (IR) light.
- Each gas has its own absorption characteristic. The gas mixture is transported into a sample cell, and an IR filter selects a specific band of IR light to pass through the gas. For multiple gas measurements, multiple IR filters are used.
- The higher the concentration of gas in the mixture the more IR light it absorbs. This means that higher concentrations of IR absorbing gas results in lower transmission of IR light.
- The amount of IR light transmitted through an IR absorbing gas is measured.
- From the amount of IR light transmitted, the concentration of gas can be calculated. This calculation provides the gas concentration value.

O_2 gas cannot be measured with this technique as it does not absorb IR light. Hence O_2 gas is measured with a sensor that makes use of the paramagnetic properties of O_2 for its fast measurement technique.

Theory of Operation

Figure 30 shows the functional blocks within the Philips M1026A Anesthetic Gas Module.

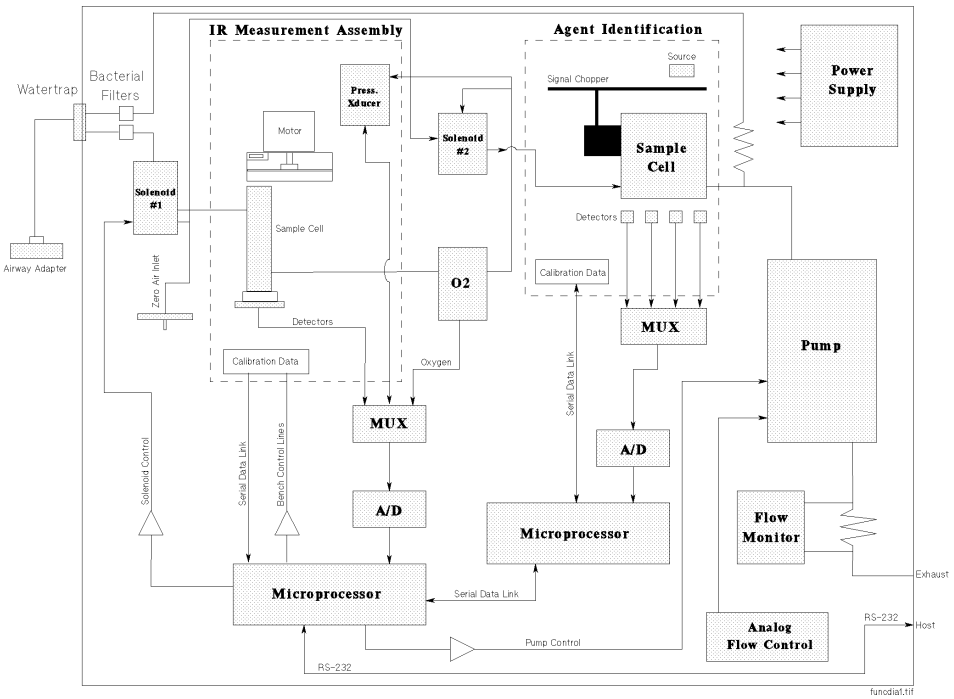


Figure 30 Anesthetic Gas Module Functional Block Diagram

The main components of the Philips M1026A Anesthetic Gas Module are:

- Main PC Board.

- Switching Power Supply.
- Pneumatic System.
- Agent Identification.
- O_2 Sensor.
- Infrared Measurement Assembly.

Main PC Board

This digital board:

- Controls the pneumatic system and the IR measurement assembly.
- Converts the preamplified analog output signal from the IR detector into a digital value. Under software-controlled processing, this is then converted to a fully compensated gas concentration value.
- Converts analog signals from the sample cell pressure sensor, transducer, sample cell temperature thermistor, and the ambient temperature thermistor, into digital environmental data for gas compensation and data reporting.
- Converts an analog O_2 signal, supplied by the O_2 measurement system, into O_2 concentration data for CO_2 compensation and O_2 data reporting.
- Converts analog signals from the flow-control servo system and power supply into digital data for status reporting.
- Processes the algorithm for end-tidal, inspired and respiration rate values.
- Controls the communication between the monitor and the Philips M1026A Anesthetic Gas Module through an RS232 interface that uses a standard communications protocol.
- Contains the software program that controls the Philips M1026A Anesthetic Gas Module in a 128K EPROM.

Power Supply

The input voltage is 100V - 240V. The output voltages are ±12V and +5V and the maximum output is 55W.

Pneumatic System

The main parts of the pneumatic system are:

- Watertrap.
- Pump assembly, including pump outlet filter.
- Two solenoid valves.
- Tubing system including:
  - Differential pressure transducer and restrictor for control of the total flow.
  - Measurement path.
  - Drainage path parallel to measurement path.
- Ambient air reference filter.

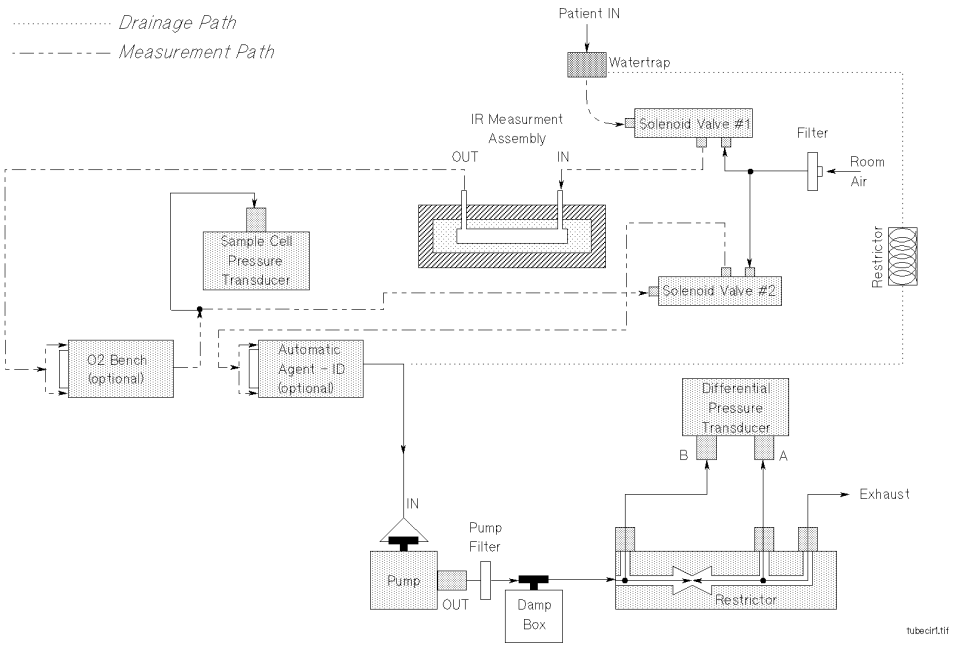


Figure 31 Pneumatic System

The pneumatic system works in the following way:

1 Eliminates residual water and fluids from patient sample gas using the watertrap and eliminates water vapor using Nafion Tubing.

2 Splits the patient's sample gas flow (150ml/min) into the measurement path (120ml/min) and drainage path (30ml/min).

3 Passes the patient's sample gas in the measurement path at 120ml/min through the measurement benches.

4 Delivers zero calibration gas to the sample cells for the periodic zeroing.

5 Exhausts the patient's sample gas, the zero calibration gas, and the span calibration gas.

6 Monitors for an occlusion in the sampling pneumatics.

Pump

The servo-controlled pump is attached to the exhaust of the Anesthetic Gas Module. It generates the flow through the system and pulls the gas from the airway adapter through the measurement subsystems to the exhaust outlet. It also delivers the zero calibration gas to the sample cells of the measurement subsystems for the periodic zero procedures and it exhausts the patient's sample gas, the zero calibration and field calibration gases.

The flow-rate control logic drives the pump as hard as necessary to maintain the selected flow rate. A partial occlusion or an inefficient pump results in the pump being driven harder. A serious occlusion results in the pump being driven at or near its maximum load. This triggers a sensing circuit, which then reports an occlusion.

Watertrap

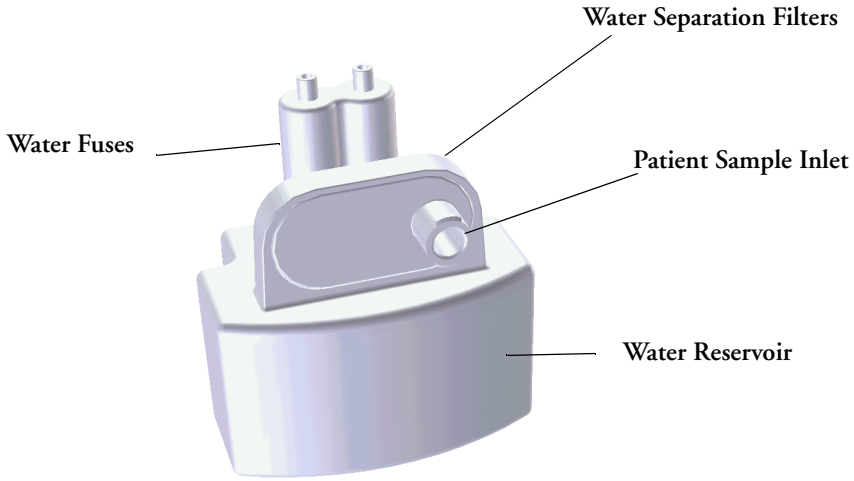


Figure 32 Watertrap

The watertrap consists of two water separation filters, two water fuses and a water reservoir. The gas sample coming from the patient may contain fluids which are separated from the gas at the first water separation filter. The gas is then split into two paths, the “measurement” path with the main part of the total gas flow (including water vapor) continuing on the “dry” side of the separation filter and the “drainage” path (containing any liquid droplets) with the smaller amount of the total flow continuing on the “wet” side of this filter. At the pump both gas paths are recombined.

The watertrap proper includes “water fuses” in both the “measurement” and the “drainage” paths, consisting of a material that swells when getting wet (when the reservoir is full or when fluid penetrates the separation filter and enters the “measurement” path) and blocks the respective path at the inlet of the unit. Once the “water fuses” are blown, any passage of fluid is blocked and the gas flow resistance increases so that an occlusion is detected.

Sample Flow Through the Pneumatic Path

- The drainage path serves to withdraw fluid separated from the gas sample into the watertrap reservoir, so that the AGM interior is protected from fluid that might cause an occlusion in the measurement path.The drainage path leads into the large watertrap reservoir where all liquid water and other fluids are collected. When the drainage path leaves the watertrap through a water separation filter and a through a water fuse it leads through internal Nafion tubing then through a bacterial protection filter and flow restrictor directly to the pump. This flow restrictor determines the percentage distribution between drainage and measurement path flow.
- The measurement path leads through a water separation filter and through a water fuse on into the measurement system. The patient sample gas (on the measurement path) then flows through internal Nafion tubing and through a bacterial protection filter to the first solenoid valve. Room air for the zero calibration is alternatively input (via a dust filter) to this solenoid valve. The solenoid valve switches between the two gases depending on the current mode of operation - normal measurement or zero calibration.

The patient sample gas or zero calibration gas then flows through the measurement subassemblies:

- the IR Measurement Assembly (for measurement of anesthetic agent, CO_2 and N_2O)
- the O_2 cell (if present)
- the Agent Identification assembly.

  A second solenoid valve between the O_2 cell and the Agent Identification Assembly routes room air directly to the Agent Identification Assembly for optimal purging of the assembly during zero calibration.

  From the Agent Identification Assembly the patient sample gas or zero calibration gas flows to the pump. Before reaching the pump, it joins the drainage path again.

From here it is passed through a filter and damper to the flow sensor which consists of a differential pressure transducer and a flow restrictor. The flow sensor determines, stabilizes and limits the flow rate of the sampled gas.

After the gas has passed through the flow sensor it is routed through a second damper to the Sample Gas output.

Agent Identification Assembly

The agent ID analyzer identifies which anesthetic agents are present in a gas sample drawn from the patients's airway. The anesthetic agents are identified from a set of known anesthetic gases.

Isoflurane

Enflurane

Halothane

Sevoflurane

Desflurane

Measurement Principle

Sample gas passes through the agent identification head where the absorption characteristics of the gas are measured. This is done using NDIR technology as described in "General Measurement Principles" on page -171. The head outputs analog signals and sends them for processing to identify the anesthetic agent.

Data averaging is used to ensure accurate measurements when agent concentrations are low. The information used to calculate the concentrations of the three agents includes:

- The preamplified outputs from the IR detector.
- The thermistor output from the agent identification head.
- Zero calibration constants.

O_2 Sensor

Specifications

Weight	335 g (0.75 lbs)
Size (HxWxD)	54 x 54 x 56 mm
Calibration	**Zero:** Room Air **Span:** Suitable calibrated mixture

Measurement Principle

The O_2 sensor uses a fast O_2 measurement technique that utilizes O_2 paramagnetic properties.

Two sealed spheres forming a dumb-bell assembly are filled with N_2. The dumb-bell assembly is suspended in a symmetrical non-uniform magnetic field. The spheres take up a position away from the most intense part of the field, due to the diamagnetic force on the dumbbells. The dumb-bell assembly is then surrounded by the sample gas.

When the surrounding sample gas contains O_2, the dumb-bell spheres are forced even further out of the magnetic field by the relatively stronger paramagnetic O_2 gas. The torque acting on the dumb-bell is proportional to the paramagnetism of the surrounding gases, and can therefore be taken as a measure of the oxygen concentration.

This torque is measured by monitoring the current required in a servo system that attempts to return the dumb-bells to their normal position.

Infrared Measurement Assembly

The measurement assembly measures the IR light absorption of the gases in its sample cell (see Figure 33).

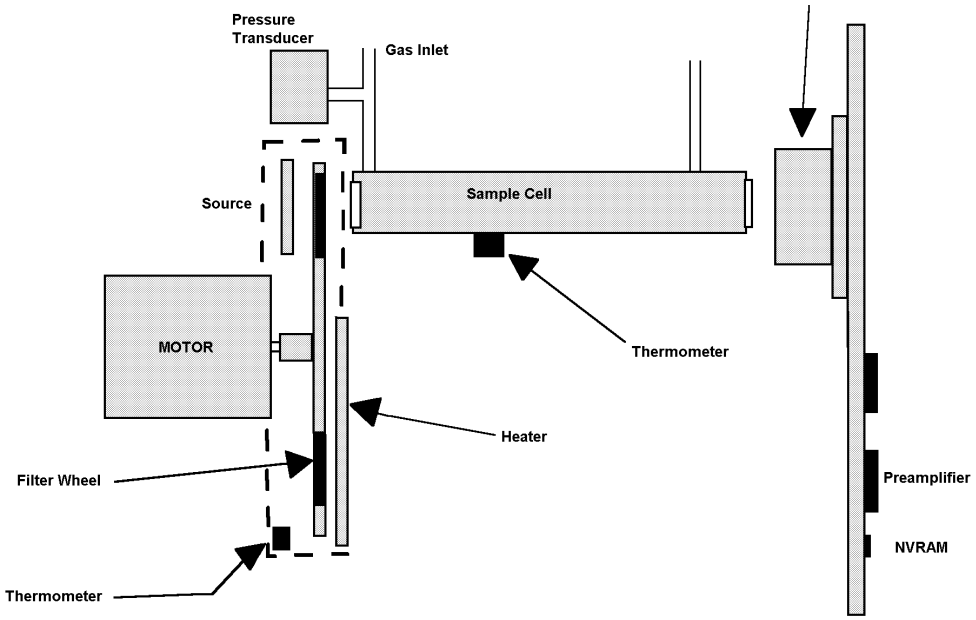


Figure 33 Anesthetic Gas Module Measurement Assembly

The measurement assembly contains the following subassemblies:

IR Source:	The ceramic IR source is heated to 600°C by applying a constant drive voltage across it.
Filter Wheel Assembly:	The filter wheel assembly includes IR filters for the anesthetic agent, CO_2, N_2O and a reference channel. A blank segment (dark period) marks the beginning and end of the filter series.
Sample Cell:	The sample cell is a stainless steel tube. It has non-IR absorbing sapphire windows at both ends, and barbed inlet and outlet ports. The inlet and outlet ports are placed as close as possible to the windows so that the gas flows effectively through the cell.
Preamp Assembly	The preamplifier board assembly includes an IR detector, an IR-detector thermistor, a TE cooler, and a pre-amplification circuit. The output from the preamplifier is a stream of pulses; this pulse train has one pulse for each IR filter, and is terminated by a blank period (dark level phase) (see Figure 34).

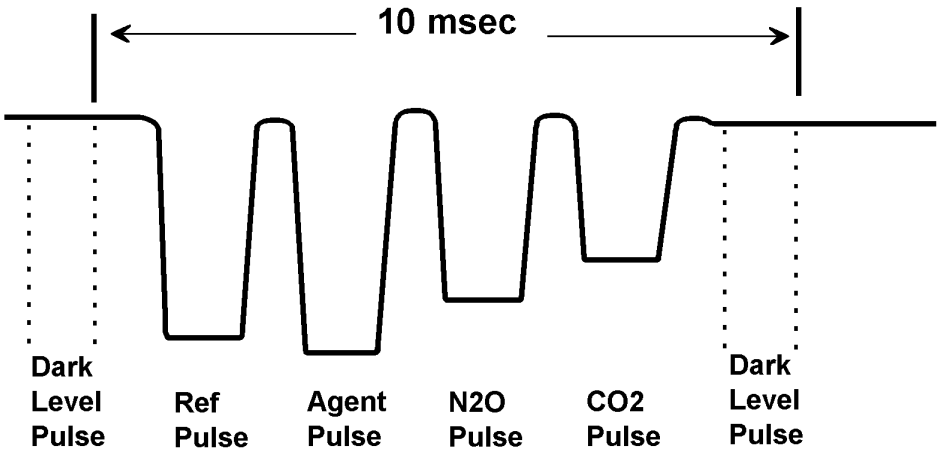


Figure 34 IR Detector Output Signal

Installation and Patient Safety

This chapter describes how to install the Philips M1026A Anesthetic Gas Module. It details the operating environment required by the Philips M1026A Anesthetic Gas Module as well as instructions on how to affix the local language labels and physically connect it to the monitor. Next, the patient safety information is detailed. Finally, this chapter describes the software setup required and any post-installation checks that have to be performed before using the Philips M1026A Anesthetic Gas Module together with a reminder of the preventive maintenance (PM) checks and their frequencies.

Where post-installation procedures are specific to installation, they are described in full in this chapter. For procedures which are also used in other situations (for example calibration, preventative maintenance, etc.), a reference to the description will be given.

Physical Installation

This section describes the operating and storage environment for the Philips M1026A Anesthetic Gas Module, affixing the local-language labels, connecting to the monitor, and fitting the gas exhaust return system.

CAUTION The Philips M1026A Anesthetic Gas Module must be positioned horizontally on a level surface. To avoid condensed water collecting in the patient sample tube, it is recommended that the Philips M1026A Anesthetic Gas Module is positioned at or above patient level, wherever possible.

Environment

WARNING Possible explosion hazard if used in the presence of flammable anesthetics.

The environment where the Philips M1026A Anesthetic Gas Module is used should be free from vibration, dust, corrosive or explosive gases, and extremes of temperature and humidity.

For a cabinet mounted installation with the monitor, allow sufficient room at the front for operation and sufficient room at the rear for servicing with the cabinet access door open.

The Philips M1026A Anesthetic Gas Module operates within specifications at ambient temperatures between 15°C and 40°C, 8 minutes after switching it on.

Ambient temperatures that exceed these limits could affect the accuracy of this instrument and cause damage to the components and circuits. Allow at least 2 inches (5cm) clearance around the instruments for proper air circulation.

CAUTION If the Philips M1026A Anesthetic Gas Module has been stored at temperatures below freezing, it needs a minimum of 4 hours at room temperature to warm up before any connections are made to it.

Make sure that the Philips M1026A Anesthetic Gas Module is free of condensation before operation. Condensation can form when equipment is moved from one building to another, thus being exposed to moisture and differences in temperature.

Label Sheet

There is a label sheet included with the Philips M1026A Anesthetic Gas Module which has the translated versions for “Airway Gases”. You can stick a translated version over “Airway Gases” on the left of the front panel. See (1) in Figure 35.

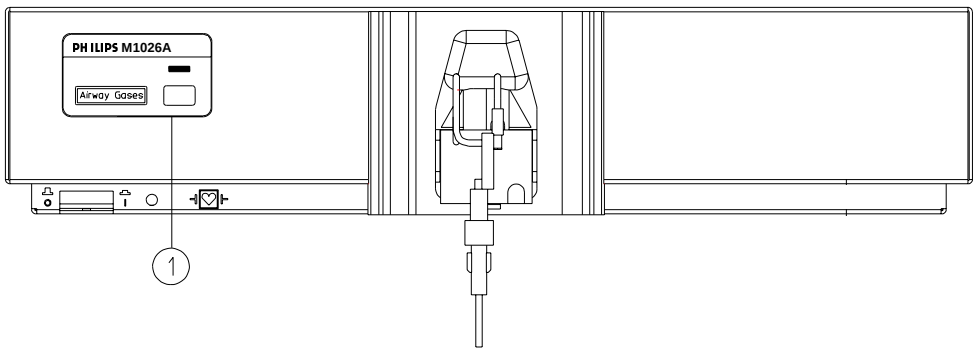


Figure 35 Label for the Philips M1026A Anesthetic Gas Module

Making Connections to the AGM

All connections to the AGM are made on its rear panel. Refer to Figure 36.

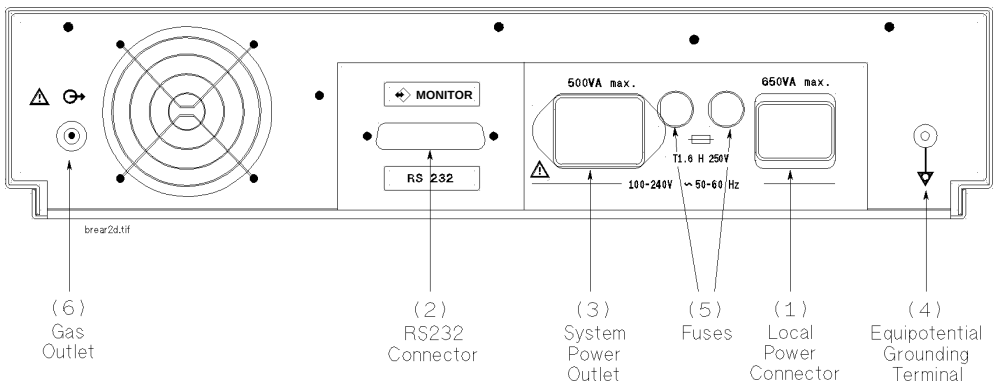


Figure 36 The Rear Panel

1 Local power connector; this is a 3-pin connector, used to connect the AGM to the local line voltage supply.

The module can be operated from an ac power source of 100 - 240 V ± 10%, 50/60 Hz. The adjustment is made automatically by the power supply inside the module.

2 RS232 Connector (RS232 Interface); this is a 25-pin "D" type connector, used to connect the AGM to the lower RJ45 connector of the monitor (Slot 04, MIB Devices - see *Installation Instructions*).

The connection can be made with the following cables:

– M1026A#K11 1 m (M1026-61001)
– M1026A#K12 3 m (M1026-61002)
– M1026A#K13 10 m (M1026-61003)

3 System power outlet (restricted use); this can be used to output power to the monitor

CAUTION The system power outlet may not be used with any other devices.

4 Equipotential Grounding Terminal; this is used to connect the AGM to the hospital's grounding system.

5 Line protection fuses, T1.6 H 250V.

6 Anesthetic gas exhaust. If N_2O and/or other inhalation anesthetics are used during anesthesia, pollution of the operating room should be prevented. Once the gas sample has passed through the AGM, it should either be **returned to** or **removed from** the anesthesia circuit.

Sample Gas Connections to the Gas Exhaust

Returning the Gas Sample

You will need the following equipment to **return** the gas sample to the anesthesia circuit:

Table 1: Gas Sample Return Equipment

Equipment	Part Number	Comments
Gas Exhaust Return Line	M1655A	Tubing includes two parts: Tube A = 50cm long Tube B = 3m long
Gas Exhaust Return Filter	M1656A	Single patient use only

NOTE The M1655A may not be available in all countries.

Setting Up the Gas Return

(see diagram Figure 37)

1 Fit the **male** luer lock connection (2) of the **shorter** tube, to the **female** side of the M1656A Gas Exhaust Return Filter.

2 Fit the **female** luer lock connection (3) of the **longer** tube, to the **male** side of the M1656A Gas Exhaust Return Filter.

3 Fit the open end (7) of the **longer** tube to the AGM's Anesthetic Gas Exhaust.

4 Fit the open end (5) of the **shorter** tube to the ventilation circuit.

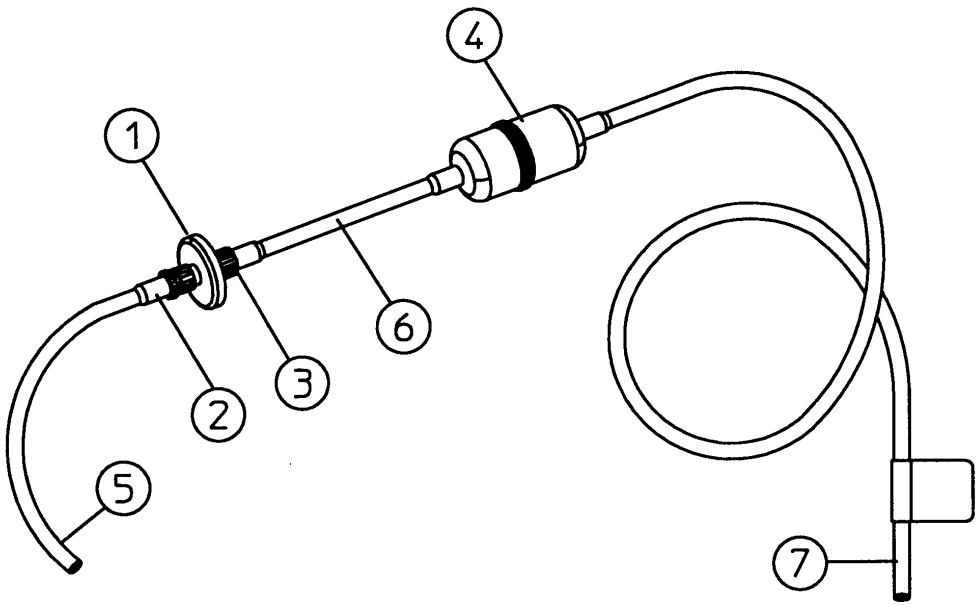


Figure 37 Setting Up the Gas Return

1 M1656A Gas Exhaust Return Filter

M1655A Gas Exhaust Return Line comprising:

2 Female luer lock

3 Male luer lock

4 Dampener

5 Shorter tube

6 Connecting tube

7 Longer tube - connected to AGM exhaust port

Removing the Gas Sample

To **remove** the gas sample from the anesthesia circuit, a scavenging system needs to be connected to the AGM's Anesthetic Gas Exhaust. If you intend to use a scavenging system with the AGM, one of the following parts must also be connected to protect it against malfunction:

1 A ventilator reservoir where the suction pressure does not exceed 0.3-0.4 mmHg or

2 A scavenging interface, properly set and maintained (see scavenging interface manufacturer's instructions).

Setup and Configuration Procedures

This section describes final setting up and configuration procedures that must be completed after the AGM is connected to the monitor and switched on but before the AGM is used for monitoring.

Altitude Configuration

The altitude setting for the monitor is important as it is used as a reference to check the AGM ambient pressure measurement.

See the Installation Instructions section for details.

Connect Sample Input Tubing

Connect the sample input tubing to the watertrap at the patient sample inlet on the water separation filter. For details, refer to the Instructions for Use.

Preventive Maintenance (PM) Tasks

The preventive maintenance (PM) tasks are described in detail in chapter 5 of this guide. Here is a short list of the PM tasks and how often they must be performed.

To ensure operation of the Philips M1026A Anesthetic Gas Module within specified limits:

1 Check the ventilator fan in the AGM for proper operation and build-up of dust and lint every **6 months**.

2 Check the AGM's calibration at least once every **12 months**, or whenever the validity of the readings is in doubt.

3 Replace the internal Nafion®; tubing, room air filter, and pump filter, internal bacterial filters and watertrap manifold seals, using the PM kit, every **12 months**.

4 Test the pump using the test procedure provided in the PM Kit every **12 months**. The square-shaped pump should be cleaned before testing; the round-shaped pump may **not** be cleaned.

5 Check electrical safety (ground impedance test and enclosure leakage current test) at least every **12 months**.

All safety and maintenance checks must be made by qualified service personnel.

WARNING Failure to implement a satisfactory maintenance schedule by the individual, hospital or institution responsible for the operation of this equipment may cause equipment failure and possible health hazards.

Post-Installation Checks

See Test and Inspection Matrix for details.

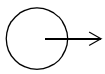
WARNING Do not use the instrument for any monitoring procedure on a patient if you identify anything which indicates impaired functioning of the instrument.

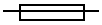
Safety Requirements Compliance and Considerations

The Philips M1026A Anesthetic Gas Module complies with the following international safety requirements for medical electrical equipment:

- UL 2601-1
- IEC-60601-1
- CSA C22.2 No. 601.1-M90
- EN 60601-1
- EN 60601-1-2

Explanation of Symbols Used

	Attention, consult accompanying documents.
	Indicates that the instrument is type CF and is designed to have special protection against electric shocks (particularly regarding allowable leakage currents, having an F-Type isolated (Floating) applied part), and is defibrillator proof.
	A gas output (this symbol is also used to indicate an electrical output on the monitor).
	A gas input (on the monitor this symbol can also stand for a video or 60V dc input).

	Equipotential grounding terminal.
	RS232 communication port.
	Fuse.
	Protective earth ground.
	Electrical shock hazard.

The Anesthetic Gas Module is protected against the effects of defibrillation and electrosurgery.

Power Supply Requirements

The system and the Anesthetic Gas Module can both be operated from an AC supply of 100 - 240V ±10%, 50 - 60Hz.

Grounding the System

To protect the patient and hospital personnel, the cabinet of the installed equipment has to be grounded. The equipment is supplied with a detachable 3-wire cable which grounds the instrument to the power line ground (protective earth) when plugged into an appropriate 3-wire receptacle. If a 3-wire receptacle is not available, consult the hospital electrician.

WARNING Do not use a 3-wire to 2-wire adapter.

Equipotential Grounding

Protection class 1 instruments are already included in the protective grounding (protective earth) system of the room by way of grounding contacts in the power plug. For internal examinations on the heart or the brain, Computer Module and Display Module of the System and the Philips M1026A Anesthetic Gas Module must have separate connections to the equipotential grounding system.

One end of the equipotential grounding cable (potential equalization conductor) is connected to the equipotential grounding terminal on the instrument's rear panel and the other end to one point of the equipotential grounding system. The equipotential grounding system assumes the safety function of the protective grounding conductor if ever there is a break in the protective grounding system.

Examinations in or on the heart (or brain) should only be carried out in rooms designed for medical use incorporating an equipotential grounding system.

Combining Equipment

If it is not evident from the instrument specifications whether a particular instrument combination is hazardous or not, for example, due to summation of leakage currents, the user should consult the manufacturers concerned or an expert in the field, to ensure that the necessary safety of all instruments concerned will not be impaired by the proposed combination.

Checking and Calibrating the Anesthetic Gas Module

This chapter explains how to check the Anesthetic Gas Module to ensure that it is operating within its specified limits. A list of the equipment required to carry out the checks is included, as well as step-by step instructions for the calibrations.

If you receive fail indications while testing, refer to the troubleshooting section of this chapter for guidance. If you are instructed to remove or replace parts of the Anesthetic Gas Module refer to the respective section.

Access Service Functions of the M1026A Anesthetic Gas Module

Enter service mode and select the service screen (see *Testing and Maintenance* for instructions on entering service mode). In the **Setup Gas Analyzer** menu you can choose whether the **Gas Analyzer Diagnostic** window or the **Gas Analyzer Calibration** window should be displayed. In this window you can as well start the flow calibration, the barometric pressure calibration and the gas span calibration.

The **Setup Gas Analyzer** menu can be accessed by either going to the **Main Setup** menu and selecting **Gas Analyzer**, or by pressing the setup key on the Anesthetic Gas Module.

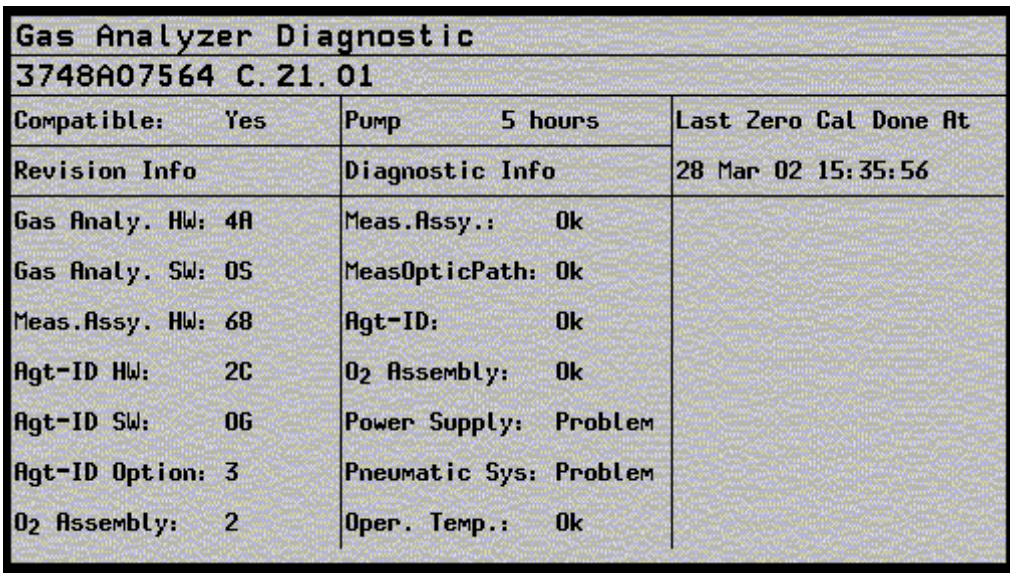


Figure 38 Gas Analyzer Diagnostic Window

This window provides you with diagnostic information about the AGM. In the **Setup Gas Analyzer** menu select **Service Window** then select **Calibration** to access this window.

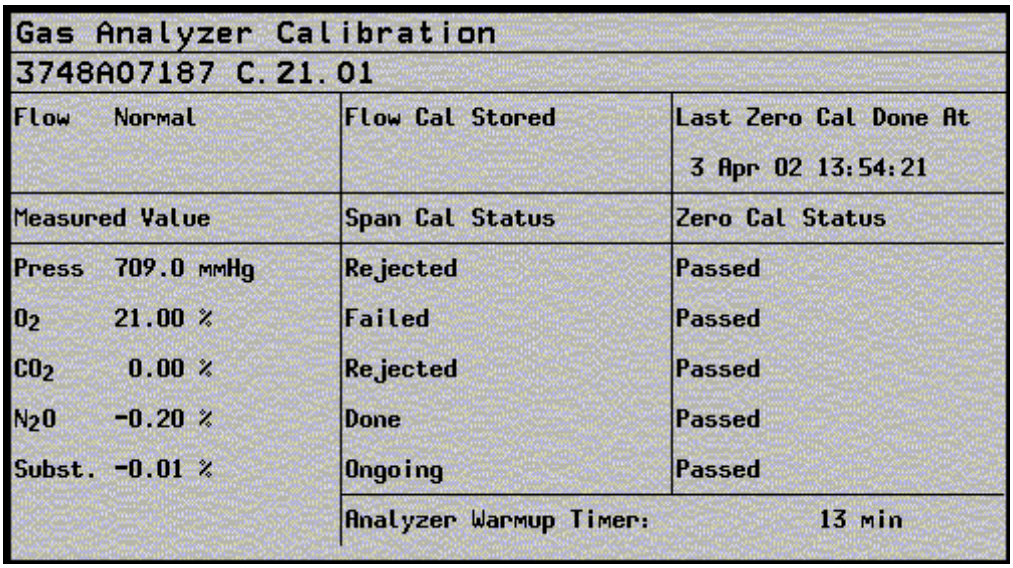


Figure 39 Gas Analyzer Calibration window

This window provides you with information about all calibrations that can be performed on the Anesthetic Gas Module. In the **`Setup Gas Analyzer`** menu select **`Service Window`** then select **`Diagnostic`** to access this window.

When and how to check the Philips M1026A Anesthetic Gas Module

To ensure that the Philips M1026A Anesthetic Gas Module operates with the specified limits, it must be checked:

1 After installation

2 Every 12 months ***or*** if the measurements are in doubt.

3 After repairing the AGM

If you find values outside the tolerance limits while checking, the Philips M1026A Anesthetic Gas Module must be recalibrated. Tolerance values are given at the end of each section.

The basic steps to check the Philips M1026A Anesthetic Gas Module are:

1 Enter Service Mode at the monitor and wait for first automatic zero calibration after the warm-up period.

2 Perform:

a. a leakage check

b. a flowrate check

to ensure that there are no leaks in the gas system and that the flowrates are set correctly.

3 Perform Zero calibration.

4 Check that there are no reported errors.

5 Check the Barometric Pressure calibration; perform it if necessary.

6 Check the Span calibration of gases; perform it if necessary.

7 If Barometric Pressure or Span calibrations were performed, re-perform Zero calibration.

WARNING Only perform Zero, Barometric Pressure and gas Span calibration checks when the top cover is closed. Light and electro-magnetic interference can affect the measurements.

Equipment required for checking

The following equipment is required for checking the AGM. Part numbers are given in the Parts List section.

1 Electronic Flowmeter M1026-60144 (Instructions are provided with the flowmeter. See also Service Note M1026A-034).

2 Span Calibration Equipment.

– Calibration Gas.

– Calibration Tubing

WARNING Philips Calibration Gas contains Halocarbon 22. Halocarbon 22 is represented in the Calibration menu by “Substitute”, which is the default. If you are using another calibration gas, this must be selected in the menu.

Checks and adjustments

The following sections explain the steps needed to carry out the checks and adjustments. A complete check and calibration procedure requires approximately 45 minutes, including waiting time.

NOTE Make sure that the watertrap is attached.

Performance Leakage Check

Complete the following steps to do a performance leakage check:

NOTE Do not perform the leakage check while a Zero calibration is running.

1 Switch on the Philips M1026A Anesthetic Gas Module and the monitor.

2 Wait until the Anesthetic Gas Module enters the warm up phase.

3 Connect a flowmeter to the exhaust outlet of the Philips M1026A Anesthetic Gas Module.

4 Connect the watertrap to the watertrap manifold.

5 Note the flowrate.

6 Block the gas inlet at the watertrap inlet connector (use your fingertip).

The reading at the flowmeter should decrease to Zero (see table below). If it does not, systematically block the pneumatic path at various points before the pump to isolate the leakage point. (See Figure 31, "Pneumatic System" for tubing connections.) When the fault has been corrected, repeat the leakage check.

7 Connect the flowmeter to the inlet.

8 Note the flowrate.

9 Block the Anesthetic Gas Module exhaust (using your finger tip).

10 Check the effect of blocking the exhaust.

The reading at the flowmeter should decrease to Zero (see Table 4-1). If it does not, systematically block the pneumatic path at various points after the pump to isolate the leakage point. (See Figure 1-2, "Pneumatic System" for tubing connections.) When the fault has been corrected, repeat the leakage check.

Items	Value / Tolerance
Leakage	Range: 0 → 4 ml/min

Performance Diagnostic Check

Complete the following to do a performance diagnostic check:

1 Enter the service mode of the monitor and let the Philips M1026A Anesthetic Gas Module complete the warm-up phase (the **GA WARMUP** INOP disapears).

2 Make sure that the watertrap is attached.

3 In the **Setup Gas Analyzer** menu select **Service Window** then select **Diagnostic** to access the **Gas Analyzer Diagnostic** window.

4 Check that no permanent problems are reported for the Philips M1026A Anesthetic Gas Module in the **Gas Analyzer Diagnostic** window.

Performance Flowrate Check

Always perform a leakage check before the flowrate check. Three flowrates need to be checked in the following order:

1 Total flow in **Purge** mode.

2 Flow in **Measurement Path** in **Normal** mode.

3 Total flow in **Normal** mode.

These flowrate checks are described in the following three procedures.

The total flow is measured by connecting the flowmeter to the exhaust, the measurement path flow is measured by connecting the flowmeter to the gas inlet with a special test fixture.

The Flowrate values are summarized in the following table:

Total Flowrate	Value
Purge	310 ml/min
Normal	150 ml/min

NOTE Do not perform the flowrate check while a Zero calibration is running.

Total Flowrate Check and Adjustment in Purge Mode

To make the flowrate measurements and any necessary adjustment:

1 Enter the service mode of the monitor and let the Philips M1026A Anesthetic Gas Module complete the warm-up phase (the **GA WARMUP** INOP disapears).

2 In the **Setup Gas Analyzer** menu select **Service Window** then select **Calibration** to access the **Gas Analyzer Calibration** window.

3 Enter the **Setup Gas Analyzer** menu and select **Start Flow Cal**.

4 Select **Flow Rate**.

5 Select **Purge** for purge flow (310 ml/min).

6 Connect a flowmeter to the exhaust port of the Philips M1026A Anesthetic Gas Module.

7 Note the actual flowrate by following the instructions accompanying the flowmeter. If the actual flowrate is outside the tolerance, it must be adjusted. If no adjustments are required, select **Stop Flow Cal**.

Total Flowrate in Purge Mode	Tolerance
310 ml/min	+/- 15 ml/min

Flowrate Adjustment

8 Remove the Philips M1026A Anesthetic Gas Module top cover (see “The Top Cover” on page 230)

9 Correct the flowrate by adjusting potentiometer **R125** on the Main PC board until the required value is achieved.

Flowrate Calibration

10 If you have made adjustments you must save the settings. Therefore select **Store Flow Cal** and confirm when prompted.
The system then runs through various flowrates and switches the pump off before it saves the values internally.
The flow display in the **Calibration** window reflects these changes and the status “Flow Cal Stored” appears.

11 Disconnect the flowmeter from the exhaust port.

Measurement Path Flowrate Check and Adjustment

The flowrate of the measurement path is checked using a test fixture in the form of a modified watertrap. In order to perform the flow rate check, the following equipment is required:

- Flow Split Test Tool M1026-60136
- Electronic Flowmeter M1026-60144

NOTE

1 Check that the test fixture is still valid for use. It must be less than two years old. The test fixture is labelled with a “Received” date that needs to be filled in when the test fixture is received.

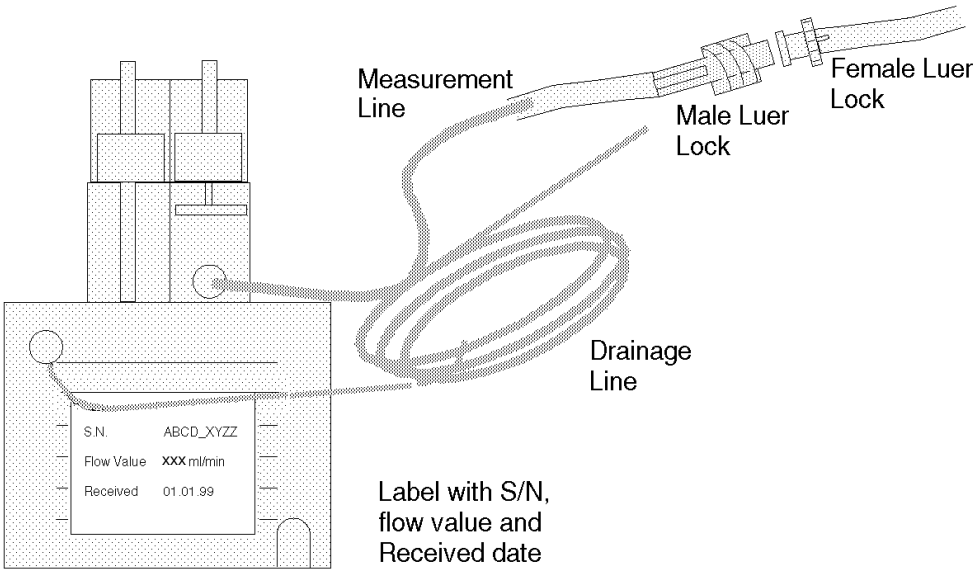
2 The flow value that is labelled on the test fixture is to be used to perform the measurement path flowrate check. It is only valid for this test fixture.

3 Check the test fixture visually for leaks. Regularly perform a leakage check with the test fixture attached instead of the watertrap. Block both lines (drainage and measurement) at the same time

while performing the leakage check. Block the measurement line with a luer cap or a similar device and the drainage line with your fingertip. If a leak exists, replace the test fixture.

WARNING Always handle the test fixture carefully and avoid contact with dust. Do not change or modify the test line/loops as this can change the flow resistance.

Make sure that there are no sharp bends or kinks in the tubing that leads to the test fixture. If a kink is visible, replace the fixture and use the new one.



TEST FIXTURE

To make the flowrate measurements and any necessary adjustment:

1 Enter the service mode of the monitor and let the Philips M1026A Anesthetic Gas Module complete the warm-up phase (the **GA WARMUP** INOP disapears).

2 In the **Setup Gas Analyzer** menu select **Service Window** then select **Calibration** to access the **Gas Analyzer Calibration** window.

3 Enter the **Setup Gas Analyzer** menu and select **Start Flow Cal**.

4 Select **Flow Rate.**

5 Select **Normal**for normal flow (150 ml/min).

6 Remove the watertrap from its manifold and connect the flow split test fixture to the Philips M1026A Anesthetic Gas Module.

7 Connect the measurement line of the test fixture to the flowmeter using the mal Luer Lock.

Check 8 Note the actual flowrate by following the instructions accompanying the flowmeter. If the actual flowrate is outside the tolerance, it must be adjusted. The target value for the flow is labelled on the test-fixture. If no adjustments are required, select **Stop Flow Cal**.

Measurement Path Flowrate	Tolerance
Value labelled on Test Fixture	+/- 3 ml/min

Flowrate Adjustment

9 Remove the Philips M1026A Anesthetic Gas Module top cover (see the respective section in this manual)

10 Correct the flowrate by adjusting potentiometer **R126** on the Main PC board until the required value is achieved.

Flowrate Calibration

11 If you have made adjustments you must save the settings. Therefore select **Store Flow Cal** and confirm when prompted.
The system then runs through various flowrates and switches the pump off before it saves the values internally.

12 Disconnect the flowmeter from the test-fixture.

13 Replace test-fixture with watertrap

Total Flowrate Check in Normal Mode

To make the flowrate measurements and any necessary adjustment:

1 Enter the service mode of the monitor and let the Philips M1026A Anesthetic Gas Module complete the warm-up phase (the **GA WARMUP** INOP disapears).

2 Enter the **Setup Gas Analyzer** menu and select **Start Flow Cal**.

3 Select **Flow Rate**.

4 Select **Normal** for normal flow (150 ml/min).

5 Connect a flowmeter to the exhaust port of the Philips M1026A Anesthetic Gas Module.

Check

6 Note the actual flowrate by following the instructions accompanying the flowmeter. If the actual flowrate is outside the tolerance, check all tubing for occlusions (for example kinks, dirt) and replace if necessary. Repeat flowrate check. If the flowrate is still no within tolerance, exchange the Nafion tubing, bacterial filters and restrictor in the drainage path (provided with the Internal Tubing Kit and the Preventive Maintenance Kit) before repeating flowrate check.
If no adjustments are required, select **Stop Flow Cal**.

Total Flowrate in Normal Mode	Tolerance
has to be between	132 ml/min 170 ml/min

7 Disconnect the flowmeter from the exhaust port.

Zero Calibration

NOTE Only perform a zero calibration with the top cover closed. Light and electro-magnetic interference may affect the measurements. Zero calibration is not possible during warm-up.

Complete the following to perform a zero calibration in service mode:

1 In the **Setup Gas Analyzer** menu select **Service Window**.

2 Select **Calibration** to access the **Gas Analyzer Calibration** window.

3 In the **Setup Gas Analyzer** menu select **Zero Cal** and press **Confirm** when prompted to.

4 Wait until zero calibration is complete. In the **Gas Analyzer Calibration** window a **OK** / **Failed** indication is displayed against each channel. If a **Failed** indication cannot be cleared by another zero calibration refer to the appropriate section of this manual and correct the fault. Then repeat this procedure.

Barometric Pressure Check and Calibration

For this calibration you need the absolute barometric pressure at your hospital location. Normally this value can be provided by the hospital as it is needed in the laboratory.

If the hospital cannot provide an accurate value for the barometric pressure, call the local airport or weatherstation. Since airports and weatherstations normally provide you with a pressure that has been corrected to sea level, ensure that the value you are given is an uncorrected absolute barometric pressure reading! The following table shows you typical barometric pressures at various altitudes.

Altitude	Typical Barometric Pressure	Altitude	Typical Barometric Pressure	Altitude	Typical Barometric Pressure
0 m	760 mmHg	1100 m	664 mmHg	2200 m	577 mmHg
100 m	751 mmHg	1200 m	656 mmHg	2300 m	570 mmHg
200 m	742 mmHg	1300 m	648 mmHg	2400 m	562 mmHg
300 m	733 mmHg	1400 m	639 mmHg	2500 m	555 mmHg
400 m	724 mmHg	1500 m	631 mmHg	2600 m	548 mmHg
500 m	715 mmHg	1600 m	623 mmHg	2700 m	540 mmHg
600 m	707 mmHg	1700 m	616 mmHg	2800 m	533 mmHg
700 m	698 mmHg	1800 m	608 mmHg	2900 m	526 mmHg
800 m	689 mmHg	1900 m	600 mmHg	3000 m	519 mmHg
900 m	681 mmHg	2000 m	592 mmHg		
1000 m	672 mmHg	2100 m	585 mmHg		

If only a corrected (to sea-level or 0 meters) reading is available, uncorrect the reading for the altitude you are on using the following equation:

$$p_{barometric} = p_{corrected} \times \frac{p_{typical}}{760\text{mmHg}}$$

where:

$p_{corrected}$ = ambient air pressure corrected to sea-level

$p_{typical}$ = typical atmospheric pressure at a given altitude

Conversion: 1 mmHg = 1.33 hPa = ? inHg

NOTE Only perform a Barometric Pressure check and calibration with the top cover closed. Light and electro-magnetic interference may affect the measurements. Pressure calibration is not possible during warm-up.

Complete the following to steps to perform a barometric pressure check and calibration:

1 Get the absolute barometric pressure at your hospital location.

2 Enter the service mode of the monitor and let the Philips M1026A Anesthetic Gas Module complete the warm-up phase (the **GA WARMUP** INOP disapears).

3 In the **Setup Gas Analyzer** menu, select **Service Window**.

4 Select **Calibration** to access the **Gas Analyzer Calibration** window.

Check

5 Check if the barometric pressure displayed next to the **Press** label. in the calibration window is within the tolerance limits. A zero calibration is automatically started in order to display the calibrated pressure value. This value is updated with each following zero calibration.

Measured Value	Tolerance
Barometric Pressure	+/- 5 mmHg

Calibration

6 Enter the **Setup Gas Analyzer** menu and select **Start Press. Cal**.

7 Select the value representing the current absolute barometric pressure and confirm when prompted

8 After calibration has been completed, check if the barometric pressure displayed next to **Press.** in the calibration window is within the tolerance limits.

Span Calibration Check

NOTE The Philips M1026A Anesthetic Gas Module should run for at least 30 minutes before continuing with the following calibration procedures. This is to allow the module to reach a stable measurement condition. The Analyzer Warmup timer in the Calibration window indicates the time span since the last power on.

Only perform Span calibration checks when the top cover is closed. Light and electro-magnetic interference can affect the measurements.

Before performing a Span calibration check, you *must* first perform:

- Performance Leakage Check.
- Performance Diagnostic Check.
- Performance Flowrate Check .
- Zero Calibration Check .
- Barometric Pressure Calibration Check .
- Ensure that there is enough gas in the calibration gas bottle.
- Check tubing assembly.

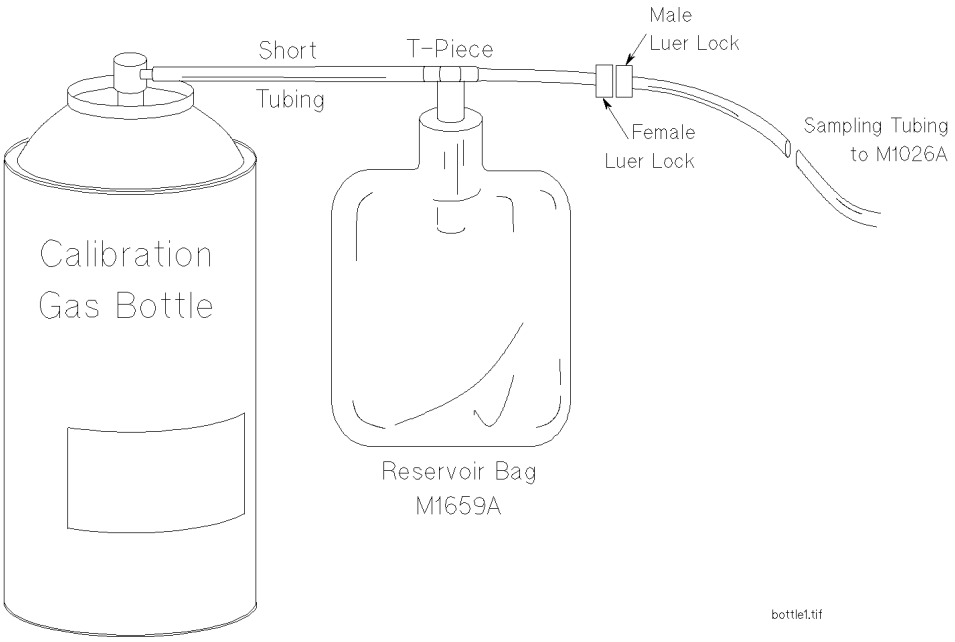


Figure 40 Span Calibration Equipment including Gas Canister and Spray Valve

CAUTION Ensure that the room you are working in is well-ventilated, and that the Philips M1026A Anesthetic Gas Module exhaust is properly connected to the gas scavenging system.

1 In the **Setup Gas Analyzer** menu select **Service Window**.

2 Select **Calibration** to access the **Gas Analyzer Calibration** window.

3 Select the **Select Cal Agent** item from the **Setup Gas Analyzer** menu.

4 Pre-select the agent that is being used during calibration. If Halocarbon 22 is in use, select **Subst.**.

5 Connect the calibration gas bottle, the reservoir bag and the sample line as shown in Figure 40, "Span Calibration Equipment including Gas Canister and Spray Valve".

6 Wait until the **GA OCCLUSION** INOP appears on the monitor. Now wait for another 10 seconds to let the Anesthetic Gas Module completely evacuate the reservoir bag.

7 Now fill the reservoir bag with gas.

CAUTION Do not pressurize the reservoir bag.

Do not attempt the calibration process if tere are any visible leaks in the bag or tubing.

Prevent the bag from emtying before the calibration procedure is complete.

Check

8 Check if the readings for the different gases in the **Gas Analyzer Calibration** window are within the specified tolerance limits.

Gas	M1660A value	Tolerance Limits
O_2	52%	+/- 1.0%
CO_2	5%	+/- 0.1%
N_2O	40%	+/- 2.0%
Anesthetic Agent or Halocarbon 22 as substitute	3%	+/- 0.1%

9 Perform a span calibration for each gas that you find out of its tolerance limits.

Calibration

10 In the **Setup Gas Analyzer** menu select the calibration item for each gas that you want to calibrate. You must have completed the flow adjusment in order to perform these calibrations. The different items are:
Start O_2 Cal
Start CO_2 Cal
Start N_2O Cal
Start Agent Cal

11 .Select the concentration of the appropriate gas in your test gas and confirm when prompted to.

12 Wait for the calibration to finish. Check that in the **Gas Analyzer Calibration** window a **Done** indication is displayed against the gas that you wanted to calibrate. If not, repeat the span calibration for this gas.
If you still get a failure refer to the troubleshooting section of this chapter and correct the fault. Then repeat span calibration.

13 Repeat steps 10 to 12 until all the gases that were out of tolerance are calibrated.

14 If any calibration was necessary, perform a zero calibration and repeat the Span Calibration Check.

15 Remove the calibration gas from the system and purge with room air for 10 seconds. Then check that the values in the **Gas Analyzer Calibration** window reflect the concentrations present in room air inside the tolerance limits:
O_2 at 20.9% +/- 0.2%
CO_2 at 0% +/- 0.1%
N_2O at 0% +/- 0.3%
Agent at 0% +/- 0.1%
If this is not the case, repeat all calibration checks and procedures.

These values are valid for the Philips M1660A Calibration Gas Mixture.

For other calibration gas mixtures use the values specified for the mixture, applying the same tolerance limits as given in this table for the Philips mixture (for example Japanese users should calibrate the Anesthetic GAs Module using the DOT29M1060 gas mixture of Schott Medical Products).

Disposal of Empty Calibration Gas Cylinder

1 Empty cylinder completely by pushing in the pin of the valve.

2 Once the cylinder is empty, drill a hole in the cylinder

CAUTION Be careful to assure that the cylinder is completely empty before you try to drill the cylinder.

3 Write "Empty" on the cylinder and place it with your scrap metal or, if you do not collect scrap metal for recycling, dispose of the cylinder.

Maintaining the Anesthetic Gas Module

WARNING Failure to implement a satisfactory maintenance schedule by the individual, hospital or institution responsible for the operation of this equipment may cause equipment failure and possible health hazards.

This chapter describes the **Preventive Maintenance** tasks (PMs) required to keep the Philips M1026A Anesthetic Gas Module in good working order. PMs are performed to a timetable before problems arise as a means to reduce failures.

Where a PM requires either a calibration or replacement procedure, you will be referred to the relevant chapter of this guide. The PMs are listed, within a table, in ascending order of the frequency they are performed.

All checks that require the instrument to be opened must be made by qualified service personnel.

CAUTION Take precautions when dealing with potentially contaminated parts, such as tubing and other components of the patient circuit. Wear gloves, mask and gown while handling components that come into contact with the patient's exhalant gas or fluids.

Preventive Maintenance (PM) Tasks

Here is a list of the PM tasks required to ensure satisfactory operation of the Philips M1026A Anesthetic Gas Module within its specified limits and how often they must be performed.

- Check the ventilator fan in the AGM for proper operation every **6 months**.
- Check the AGM's calibration at least once every **12 months**, or whenever the validity of the readings is in doubt. Refer to *Checking and Calibrating the Anesthetic Gas Module* for details.
- Replace the internal Nafion® tubing, room air filter, and pump filter, two internal bacterial filters, and two watertrap manifold seals using the PM kit, every **12 months**.
- Test the pump using the test procedure provided in the PM Kit every **12 months**. If the test fails, replace the pump.
- Check electrical safety (ground impedance and enclosure leakage current test) at least every **12 months**.

Cleaning

Each time the top cover is removed from the AGM for repair or calibration, you should take the opportunity to clean the inside of the module, as the fan may draw debris such as dust and lint into the enclosure.

WARNING Switch off the instrument and disconnect it from the mains power supply. Take standard electrostatic precautions. For example, wrist strap connected to electrical ground.

The user should be encouraged to periodically clean the exterior casing of the AGM. The outside of the gas sample tubing should be cleaned before connecting to the next patient.

Replace PM Parts

Every **12 months** the PM parts should be replaced for new with the PM kit (Philips Part Number M1026-60132). The PM kit comprises an internal Nafion® tubing with two internal bacterial filters, pump filter, room-air filter, and two internal bacterial filters, and two seals for the watertrap manifold.

Internal Nafion Tubing with Bacterial Filters and manifold Seals

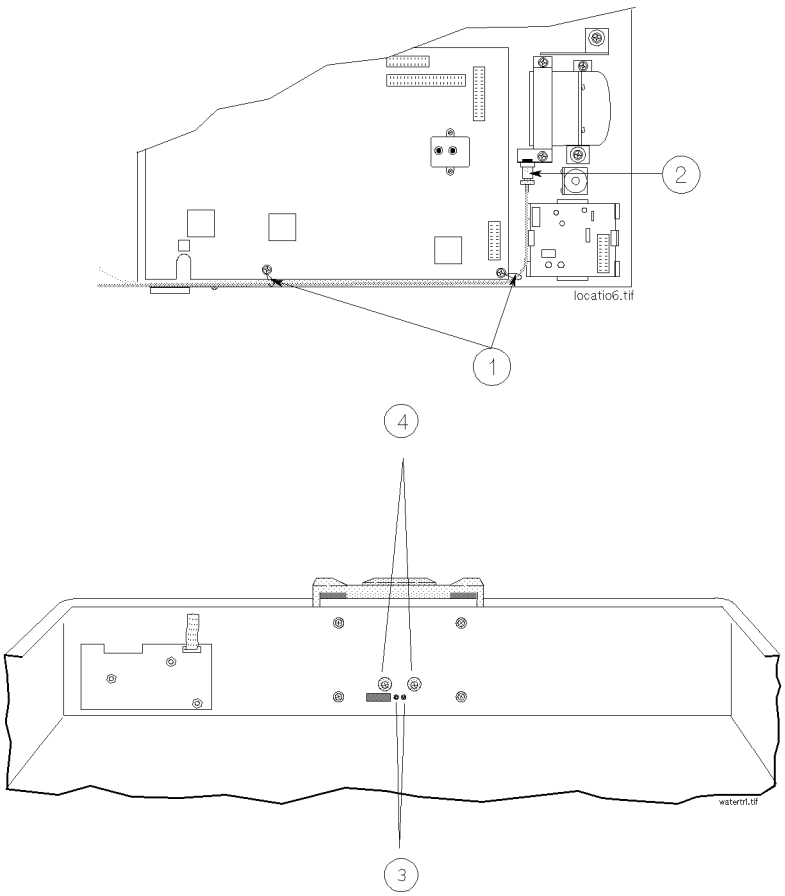


Figure 41 Removing the Nafion Tubing, Bacterial Filters and Watertrap Manifold Seals

Removal

To remove the Nafion® tubing, filters and manifold seals (refer to Figure 41):

1 Ensure that the module is switched off and isolated from the mains power supply. Remove the top cover of the module. Check if the module needs cleaning (because of dust, lint, etc.).

2 Unscrew the cable clamps (1) holding the Nafion tubing in place on the main PC board.

3 Unscrew the bacterial filters (2) at the metal bracket.

4 Remove the Nafion tubing connections (3) from the watertrap manifold.

5 Remove the two screws (4) holding the watertrap manifold on the protector. The screws are accessible from the rear side of the front cover through two holes provided for this purpose.

6 Pull out the two seals from the tubing connectors of the manifold using pointed tweezers; slide one side of the tweezers between the seal and the connector, then grasp and pull.

Replacement

To replace the Nafion® tubing, filters and manifold seals (refer to Figure 41):

1 Take a new seal in the tweezers and press it onto the fitting in the tubing connector. Push down on the seal using the handle of the tweezers (or another blunt instrument), taking care not to damage the seal, until it sits properly. Repeat with the second seal.

2 Screw the watertrap manifold onto the protector through the holes in the front cover.

3 Replace the Nafion tubing connection to the watertrap manifold. Take care to attach the tubing with the red mark at the end to the connector with the red marking (this indicates the "drainage" path). The gap between the end of the nafion tubing and the manifold connectors (visible through the purple connector tubing) must be less than 1mm.

4 Replace the Nafion tubing connection to the metal bracket. Screw on the bacterial filters, again matching the red markings.

5 Attach the cable clamps to the Nafion tubing (if not already attached) and screw the cable clamps onto the main PC board.

Room-Air Filter

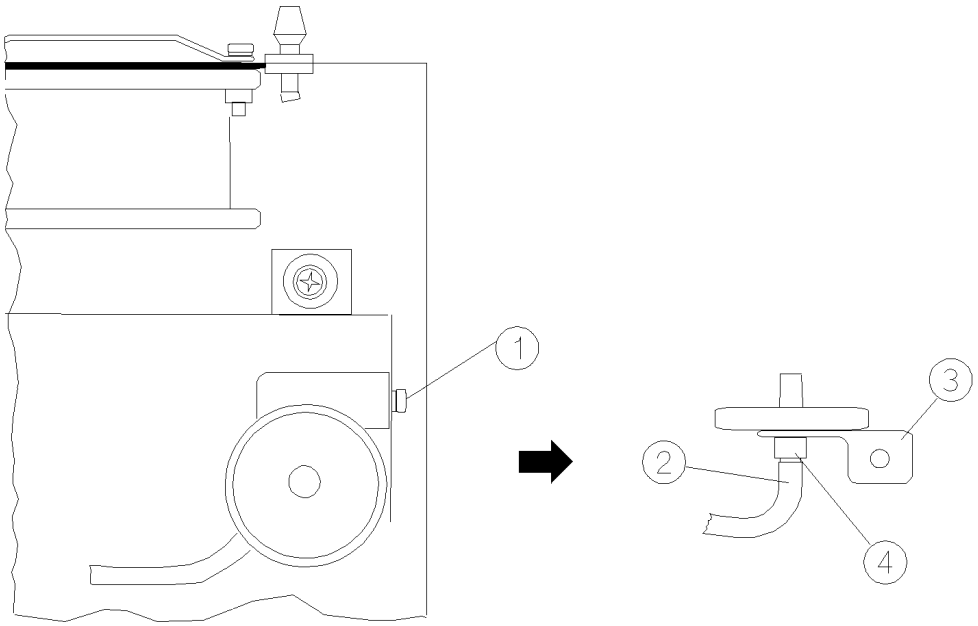


Figure 42 Removing and Replacing the Room-Air Filter

Removal

To remove the room-air filter (refer to Figure 42):

1 Using a cross-tipped screwdriver, remove the screw and washer (1) securing the room-air filter's mounting bracket.

2 Remove the pneumatic tubing (2) from the underside of the room-air filter.

3 Using a flat-tipped screwdriver, pry off the short section of tubing (4) that secures the room-air filter to its bracket (3).

4 Remove the room-air filter from its bracket.

Replacement

To replace the room-air filter (refer to Figure 42):

1 Push the room-air filter into the locating hole provided in its bracket (3).

2 Push on the short section of tubing (4) that secures the room-air filter to its bracket.

3 Replace the pneumatic tubing (2) to the underside of the room-air filter.

4 Using a cross-tipped screwdriver, replace the screw and washer (1) securing the room-air filter's mounting bracket.

Pump Filter

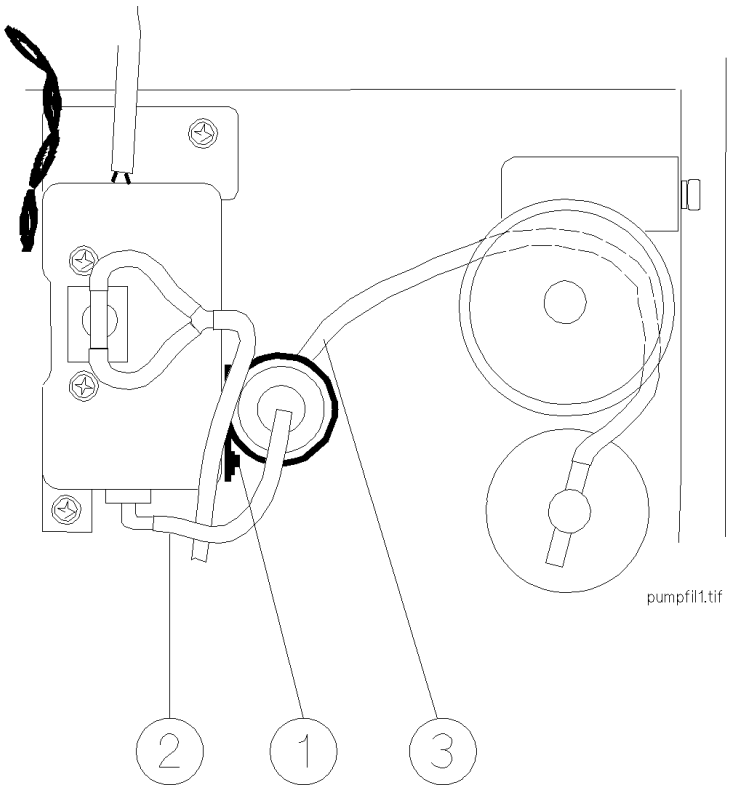


Figure 43 Removing and Replacing the Pump Filter

Removal

To remove the pump filter (refer to Figure 43):

1 Using a cross-tipped screwdriver, remove the screw securing the pump filter(1).

2 Lift the pump filter and remove the pneumatic tubing from the pump exhaust (2).

3 Press the filter out of its plastic clip and remove the tubing from the underside of the pump filter (3).

Replacement

To replace the pump filter (refer to Figure 43):

1 Connect the open tubing end that comes with the filter to the pump exhaust (2). Ensure that the elbow connector on the pump filter is connected to the pump exhaust.

2 Replace the pump filter and secure with the screw (1).

3 Pass the tubing through the clip and connect it to the underside of the filter and slide the pump filter into its plastic clip (3).

4 Replace the top cover of the module.

Performance Checks

See *Test and Inspection Matrix.*

Other factors to maximize uptime or reduce cost of ownership:

Electromechanical devices in general have limited life expectancies and failure rates higher than devices with only electronic components. Thus, lower cost electromechanical devices such as pumps and solenoids should be pro-actively considered for replacement.

We recommend exchanging the pump M1026-60330 after 6000 hours.

Changing the solenoids after 3000 hours will also maximize AGM uptime.

Any change in recommended exchange intervals will be communicated via Service Notes.

Troubleshooting the Anesthetic Gas Module

This chapter provides a recommended procedure for locating and identifying faults on the Philips M1026A Anesthetic Gas Module.

It details how to proceed when hardware or measurement related INOPs occur.

It details how to proceed when errors are flagged for:

- Failed calibration checks and procedures
- Failed diagnostic checks.

In addition, it provides flow charts for communication and measurement type problems.

Equipment needed for troubleshooting:

- Flowmeter
- Flow Split Test Kit
- PM Kit
- Multimeter
- Calibration equipment
- Tubing kit

Compatibility Criteria for the AGM and the IntelliVue Monitors

Compatibility criteria can be checked in the Gas Analyzer Diagnostic Window. For compatibility with the IntelliVue patient monitors the AGM must fulfill the follwoing requirements:

Protocol Revision: C.21.xx or greater

Agt_ID Option: 3

O_2 Assembly: 2

Flow Charts for Communication and Measurement Type Problems

The first flow chart shows three common types of problems and the identification information needed about the AGM.

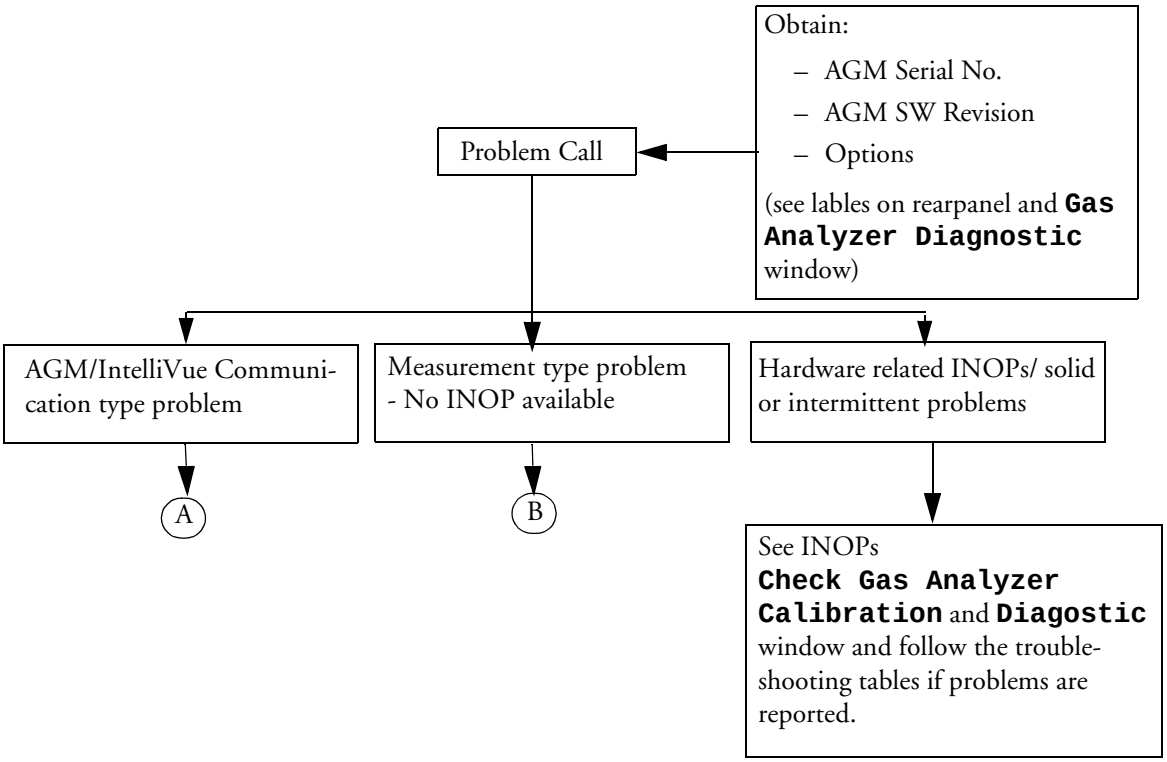


Figure 44 Troubleshooting - Problem Identification

To access the identification information, refer to the **Revision Info** column of the **Gas Analyzer Diagnostic** window

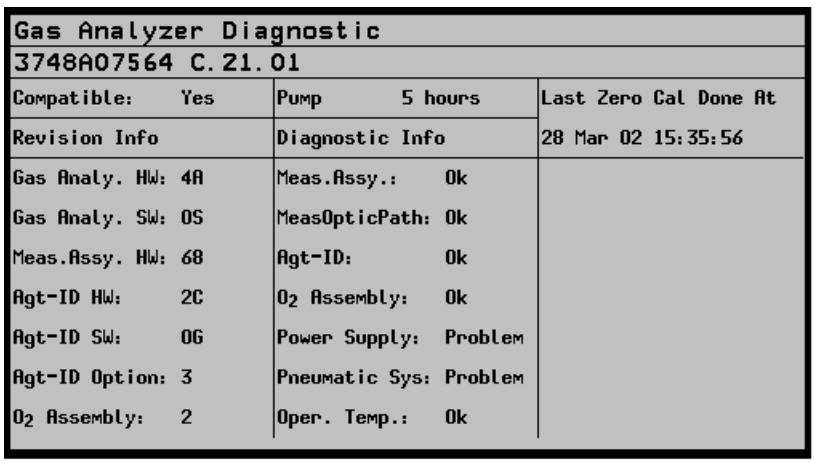


Figure 45 Gas Analyzer Diagnostic Window

This window gives such information as serial number, software revision and options configured:

The second flow chart continues from the first at the point **A** “Communication Problem”.

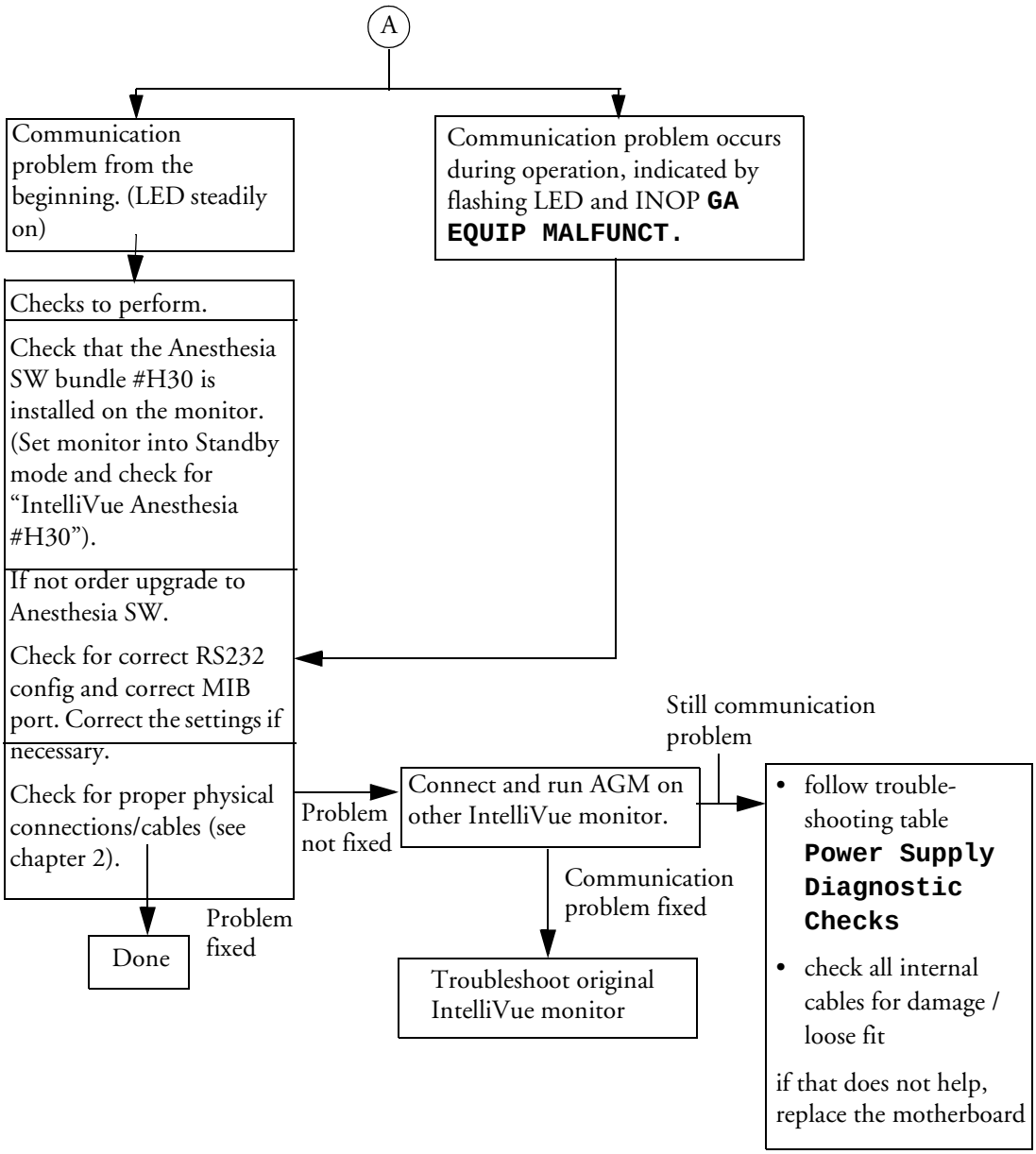


Figure 46 Troubleshooting - Communication Problems

The third flow chart continues from the first, from the point **B** “Measurement-type Problem - No INOP”.

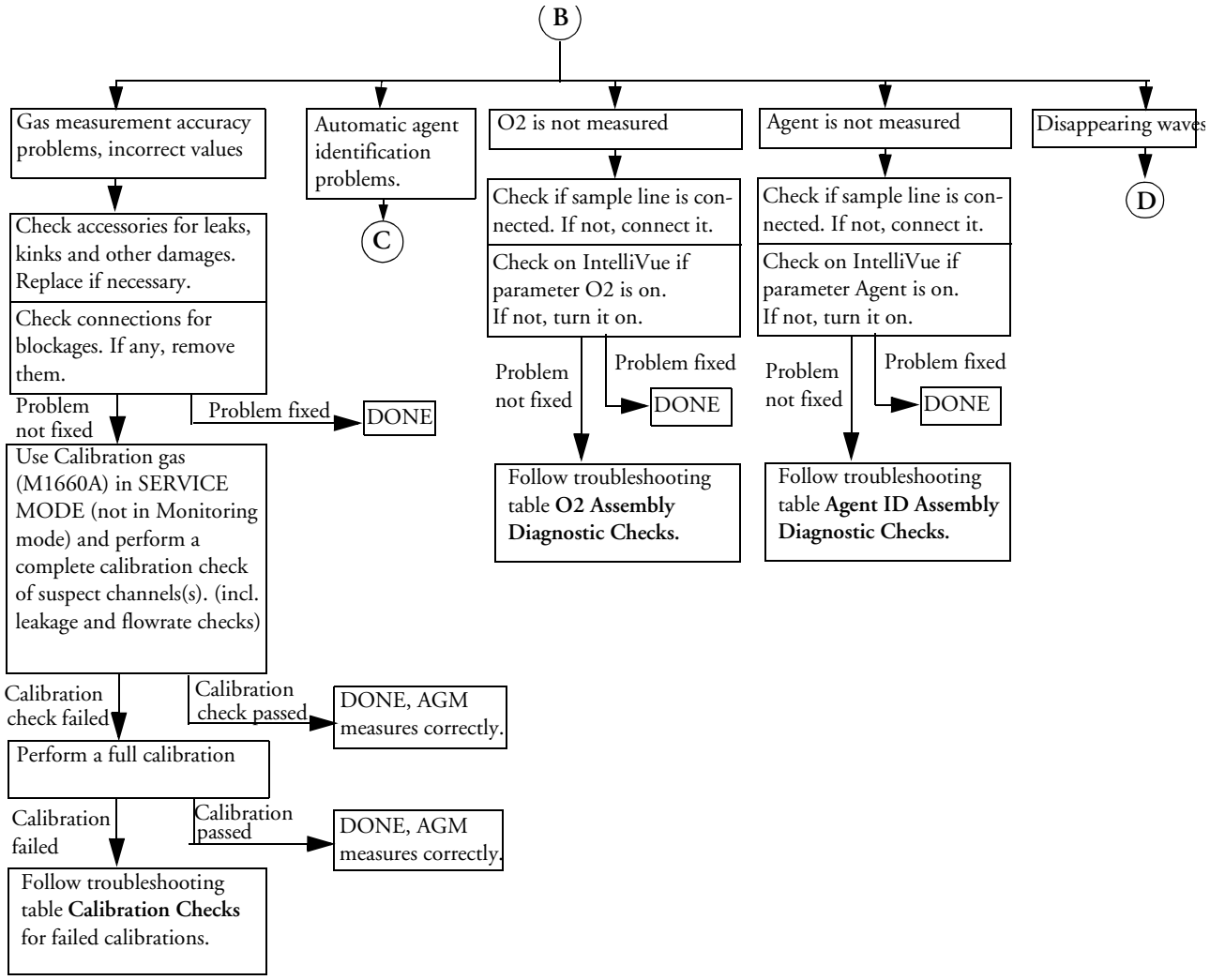


Figure 47 Troubleshooting - Measurement Problems with No INOPS

Flow charts illustrated in Figure 48 and Figure 49 follow on from here.

The fourth flow chart continues from the third, from point **C** “Agent ID Problems”:

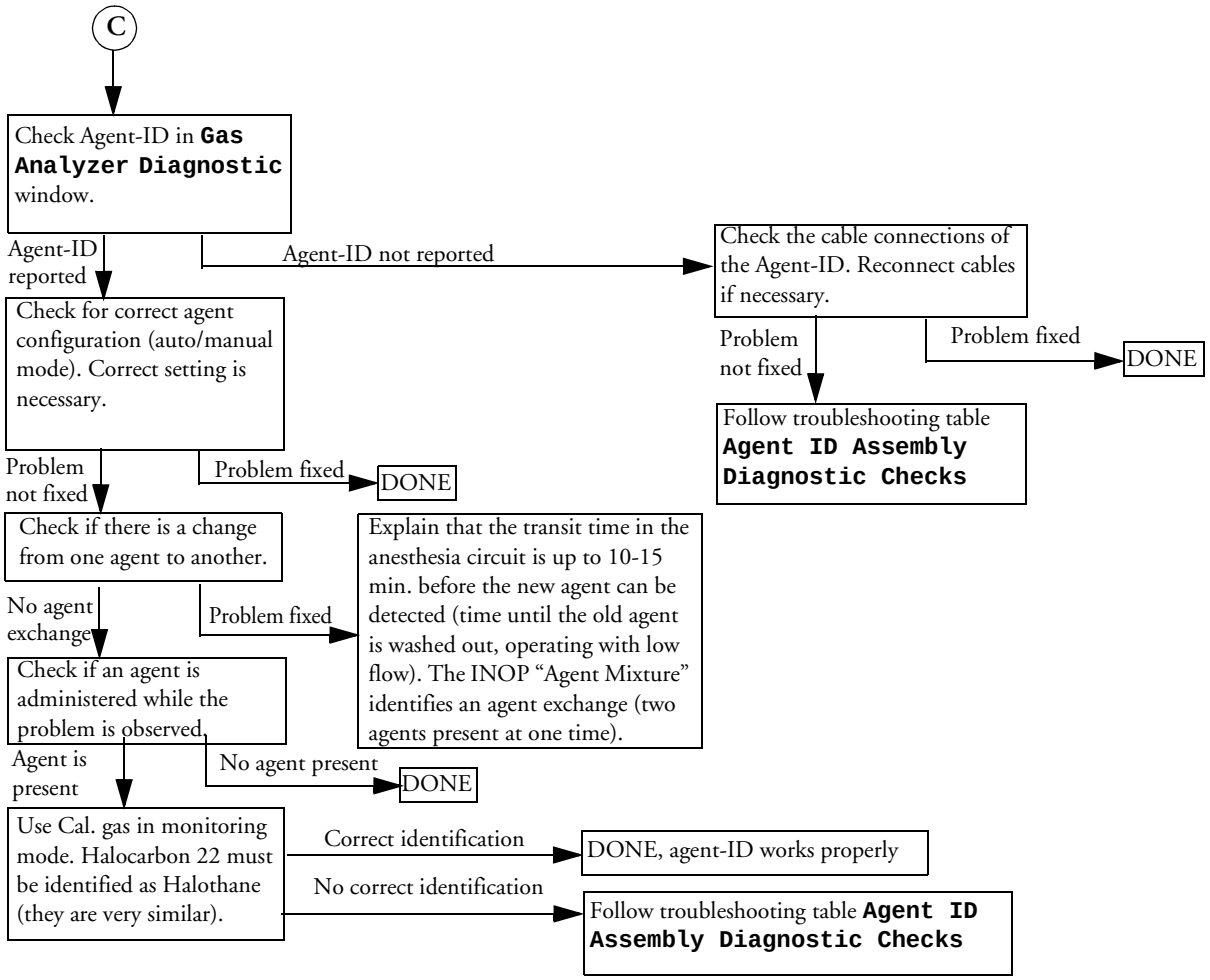


Figure 48 Troubleshooting - Agent ID Problems

The fifth flow chart also continues from the third, from point **D** “Disappearing Waves”:

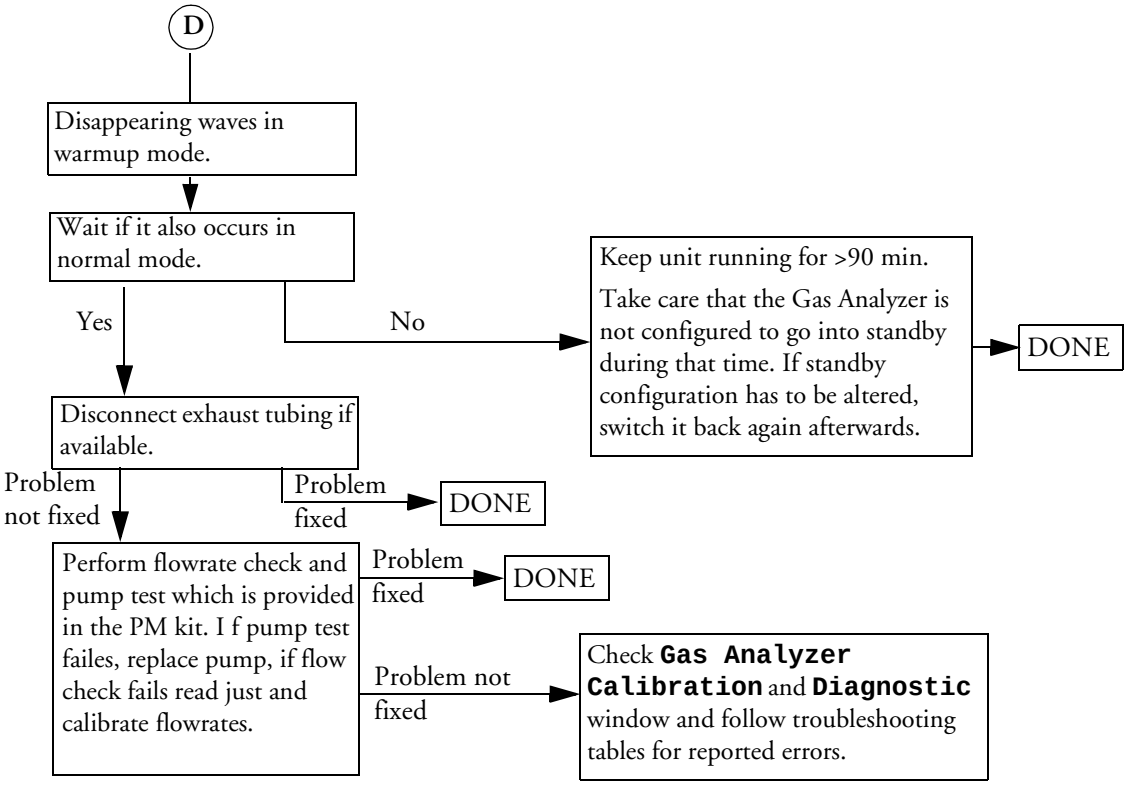


Figure 49 Troubleshooting - Disappearing Waves

Hardware Related Troubleshooting Strategy

Overall troubleshooting strategy for hardware related problems/hardware and measurement related AGM INOPs:

1 Always perform a leak and flowrate check (see Chapter) before continuing any other troubleshooting. If any check fails, first fix leak and/or flowrate problem and repeat a zero calibration. Then check whether problems still exist.

There are only two device conditions that make it impossible to perform a leak/flowrate check:

– Pump is not running:

Check for proper electrical connection and check that AGM is not in Standby Mode. If OK, replace pump.

– INOP "GAS AN. EQUIP MALF": see “INOPs” on page 210.

2 After the first zero calibration, always check which AGM INOP’s are displayed in Monitoring Mode. Refer to “INOPs” on page 210 where you can find a listing of possible root causes and their corrective actions to the most common hardware and measurement related AGM INOP’s. Check out the possible problems in the order given in the table!

3 After the first zero calibration, always check which problems are flagged in the Gas Analyzer Diagnostic window. Troubleshoot flagged problems in the Gas Analyzer Diagnostic window following the hierarchy given in “Problem Solving Hierarchy” on page 215 and the related troubleshooting tables and/or troubleshoot zero calibration failures.

INOPs

Check out the possible problems in the order given in the following table.

INOP	Possible Problem/Cause	Corrective action
GA. NOT AVAILABLE	AGM not switched on.	Switch on AGM
	AGM not properly connected.	Check physical connections.
GA INCOMPATIBLE	This version of the AGM is incompatible with the monitor	Disconnect AGM.
GAEQUIP MALF	Either AGM - monitor connection problem, serious problem with a subassembly or Main PC Board problem	Check RS232 connection, RS232 cable and MIB board of monitor. If ok, check whether status ("OK" or "PROBLEM") is shown in AG Diag Window. If yes, troubleshoot subassemblies according hierarchy. If status "UNKNOWN" is shown for all assemblies for more than 4 min. after Power On, replace main pcb.
	Serious IR measurement head problem.	Check IR head and replace it if necessary, check whether Service Note M1026A-035 applies.
GAS OCCLUSION	External occlusion (inlet or exhaust accessories).	Disconnect all external tubing/filters and check whether occlusion disappears.
	Internal occlusion.	Troubleshoot internal occlusion and remove it.
	Weak/defective pump.	Perform pump test (provided in PM Kit M1026-60132), replace it if necessary.
	Leakage between pump and flow restrictor	Check pneumatic path between pump and flow restrictor tubing for leakages.
	Flow transducer incorrectly connected to flow restrictor	Check that the transducer ports A and B on the Main PC board are connected to the correct side of the flow restrictor (Figure 1-2)

INOP	Possible Problem/Cause	Corrective action
GA ZERO FAILED	Purge Flow out of tolerance.	Adjust purge flow and calibrate flow. Repeat zero calibration.
	No flow calibration after flow adjustments	Perform flow calibration
	Occlusion during zero calibration.	Remove occlusion.
	Solenoid 1 defective.	Replace solenoid 1.
	Measured ambient pressure does not match with configured altitude in ACMS Service Mode (tolerance is +/- 60 mmHg).	Verify correct altitude setting / pressure Cal value. If necessary, adjust it.
	IR measurement head problem.	Check IR head and replace it if necessary.
O_2 ZERO FAILED	O_2 new zero constants out of range.	Troubleshoot O_2 sensor and replace it if necessary.
AGENT IDENT ZERO FAILED	Solenoid 2 defective	Replace solenoid 2.
	Agent-ID problem.	Troubleshoot Agent-ID and replace it if necessary.
O_2 EQUIP MALF	O_2 span failed.	Check O_2 span calibration. If it fails, troubleshoot span calibration/ O_2 sensor and replace it if necessary.
	O_2 is built in, but set to digital 45%.	If O_2 value is set to digital “45%” in Service Mode, replace the O_2 sensor.
AGENT IDENT MALF	Serious Agent-ID problem.	Check Agent-ID and replace it if necessary.
XXX MEAS DISTURBED	Minor transient IR head problem	If it lasts only for a few seconds and clears itself, NO ACTION REQUIRED.
(XXX: N_2O, CO_2, agent or O_2)	(Minor transient O_2 sensor problem if XXX = O_2)	If it doesn't clear itself, troubleshoot IR head/ O_2 sensor and replace it if necessary.

INOP	Possible Problem/Cause	Corrective action
GAS AN ACCURACY ?	Flow rate error.	Check flow (purge and normal), adjust and calibrate if necessary.
	No flow calibration after flow adjustment	Perform flow calibration
	Partial occlusion.	Troubleshoot for occlusion.
	IR head problem.	Troubleshoot IR head and replace it if necessary. If it lasts only for a few seconds and clears itself, NO ACTION REQUIRED
O_2 UNABLE TO MEASURE	Flow rate error.	Check flow (purge and normal), adjust and calibrate if necessary
	No flow calibration after flow adjustment	Perform flow calibration
	O_2 data not valid.	Troubleshoot O_2 sensor and replace it if necessary.
CO_2 UNABLE TO MEASURE	CO_2 span failed.	Check CO_2 span calibration. If it fails, troubleshoot span calibration/ IR head and replace it if necessary.
	CO_2 data not valid.	
AGT UNABLE TO MEASURE	Agent span failed.	Check agent span calibration. If it fails, troubleshoot span calibration/ IR head and replace it if necessary.
	Agent data not valid.	
N_2O UNABLE TO MEASURE	N2O span failed.	Check N2O span calibration. If it fails, troubleshoot span calibration/ IR head and replace it if necessary.
	N2O data not valid.	

Calibration Checks

To access the **Gas Analyzer Calibration** window select **Gas Analyzer Calibration** in the **Setup Gas Analyzer** menu.

A **Passed/Failed** indication is displayed for the Zero and the Span calibrations. Refer to the table below for possible causes of **Failed** indications, and their recommended corrective actions.

Calibration Checks Troubleshooting Table

Symptom	Possible Cause	Corrective Action
Zero calibration shows Failed/ Agent-ID Zero Calibration failed. (Agent-ID Zero failed is only seen as INOP in monitoring mode)	Solenoid or air reference filter problem.	Check the solenoid while running a Zero calibration, by feeling whether air is being pulled in at the room air filter. If not, first replace the room air filter. If the problem still persists, replace the solenoid. If Agent-ID zero calibration failed, check solenoid #2.
	Occluded pneumatics	Check for an occlusion, such as bent or collapsed tubing. Listen for a louder or higher frequency pump noise. This can indicate that the pump is working to compensate for an internal occlusion. Replace watertrap/tubing/ filter, if necessary.
	Flowrate problem.	Perform leakage check. If problem still persists, perform flowrate check.
	Flow transducer incorrectly connected to flow restrictor	Check that the transducer ports A and B on the Main PC board are connected to the correct side of the flow restrictor.
	Pump problem	Block the gas inlet port and verify that the pump is driven harder to compensate for the reduction in flow. Perform pump test provided in the Preventative Maintenance kit. Caution: The instructions on cleaning apply only to the “old-type” square shaped pump; do not clean the “new type” round pump. If the pump fails the test, replace it.
	IR measurement head problem	Check out IR measurement head . Replace if necessary.
	Agent-ID problem	Check out Agent-ID. Replace if necessary.
O_2 Zero calibration shows Failed.	Flowrate problem.	Perform leakage check. If problem still persists, perform flowrate check.
	O_2 Span problem	Perform a Zero calibration followed by a Span calibration. Check that the Span calibration is within the accepted tolerance. If not, repeat the Zero and Span calibration one more time.
	O_2 sensor problem.	If calibration still fails, perform the O_2 check for a defective sensor as described above. If the O_2 check fails, replace the O_2 sensor.

Symptom	Possible Cause	Corrective Action
Span calibration shows `Failed` (for O_2, N_2O, CO_2, agent).	Zero calibration failed for the indicated channel.	Follow corrective actions for failed Zero calibration described above.
	Agent selection or calibration values (CalValue) incorrect	Check for proper selection of Agent and calibration values .
	Flowrate problem.	Check the flowrate.
	Leakage problem.	Perform leakage check. Check integrity of tubing and replace if necessary.
	Wrong gas applied.	Check the label on the gas canister.
	Calibration reservoir bag empty or calibration gas canister empty.	Check that there is enough gas available.
	Measurement assembly problem.	Check the Gas Analyzer Diagnosticwindow for a Measurement assembly problem. If a problem is flagged, follow corrective actions as described in the troubleshooting tables. After that, or if no problem was flagged, return to the Gas Analyzer Calibration window. If the failed status is still shown against Span Calibration, repeat the Span calibration. After that, perform a Zero calibration.
O_2 Span calibration shows `Failed`.	O_2 sensor problem.	Check O_2 sensor problem as described above.

Diagnostic Checks

WARNING If you carry out checks with replacement parts, be aware of the high-voltage locations. Never remove cables or sub-assemblies while the Module is powered on.

To access the Gas Analyzer Diagnostic window select **Gas Analyzer Diagnostic** in the **Setup Gas Analyzer** menu.

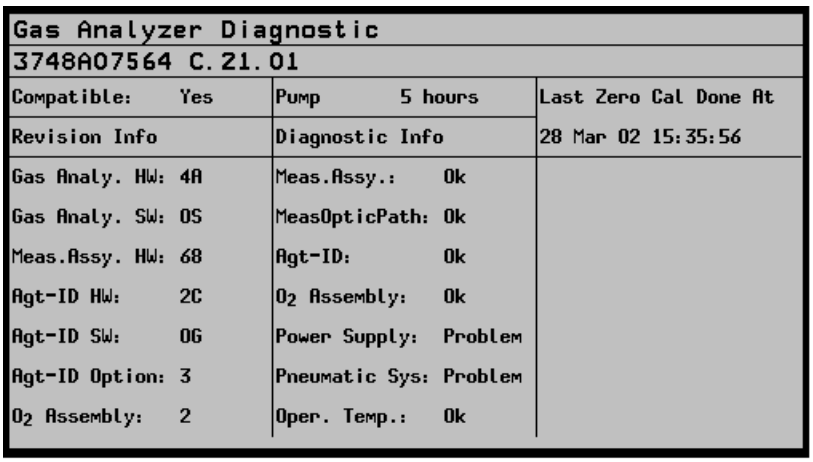


Figure 50 Gas Analyzer Diagnostic Window

Problem Solving Hierarchy

To help identify a problem, a **OK/Problem** message is displayed for major subassemblies. If a problem is displayed use the following pages to isolate the problem according to the following hierarchy (this hierarchy overrides the sequence shown on the display):

1 Pneumatic System

2 IR Measurement Assembly (**Meas. Assy**)

3 Optical Path (**Meas. Optic. Path**)

4 O_2 Assembly (**O_2 Assy**)

5 Agent ID Assembly (**Agt-Id Assy**)

6 Power Supply

7 Operating Temperature

The **Gas Analyzer Diagnostic** window also displays the number of pump operation hours.

NOTE To remove the top cover, refer to the section *The Top Cover*.

Refer to the following tables for possible causes of **Problem** indications, and their recommended corrective actions.

Pneumatic System Diagnostic Checks

Symptom	Possible Cause	Corrective Action
Pneumatic Sys. shows `Problem`	Weak pump	If this Problem is flagged temporarily during a zero calibration or purge mode this could indicate a weak pump. Replace the pump if problem persists
	Occluded pneumatics	Check for an occlusion, such as bent or collapsed tubing, or dirty room air filter. Listen for a louder or higher frequency pump noise. This can indicate that the pump is working to compensate for an internal occlusion. Replace watertrap/tubing/filter, if necessary.
	Defective cables	Check the cables for signs of damage or wear. Check the connectors for damaged or loose connections. If any defects are apparent, replace the cable.
	Solenoid or air reference filter problem	Check the solenoid while running a Zero calibration, by feeling whether air is being pulled in at the room air filter. If not, first replace the room air filter. If the problem still persists, replace the solenoid.
	Flowrate problem	Perform leakage check. If problem still persists, perform flowrate check.
	Flow transducer incorrectly connected to flow restrictor	Check that the transducer ports A and B on the Main PC board are connected to the correct side of the flow restrictor
	Pump problem	Block the gas inlet port and verify that the pump is driven harder to compensate for the reduction in flow. Perform pump test provided in the Preventative Maintenance kit. Caution: The instructions on cleaning apply only to the “old-type” square shaped pump; do not clean the “new type” round pump. If the pump fails the test, replace it.
	Defective power supply	Carry out the checks for the power supply.
	Defective main PC board.	If the checks above do not solve the problem, replace the main PC board.

O_2 Assembly Diagnostic Checks

Symptom	Possible Cause	Corrective Action
O_2 Assy shows `Problem`	O_2 jumpers incorrectly set	Check if the O_2 jumpers are correctly set.
	O_2 sensor failed Zero/ Span calibration	See calibration checks.
	Defective O_2 sensor	If two solenoids are installed, disconnect cable of solenoid #2 (near O_2 sensor). Go into Gas Analyzer Calibration window Start a zero calibration to get the actual barometric pressure reading. Note the measured barometric pressure in mmHg displayed in the Calibration window Using a voltmeter, check the O_2 sensor voltage as follows: Connect voltmeter ground to TP1. Measure TP8 voltage. 1% O_2 is approximately equal to 10mV. As the O_2 measurement is influenced by the barometric pressure, the correct voltage must be calculated as follows: O_2 concentration of gas in mV multiplied by the measured barometric pressure in mmHg and divided by 760 mmHg. For example, correct calculated voltage for room air (20.9% O_2) and barometric pressure of 720 mmHg is: 209 mV x 720 mmHg / 760 mmHg = 198mV. If the voltage is not within ±10% of calculated value, proceed to adjust O_2 Zero and Span potentiometers in the following order: Table continued on next page.

Symptom	Possible Cause	Corrective Action
		Zero Adjust: Calculate the correct voltage as described above using the actual room air O_2 concentration and measured barometric pressure. Adjust RV2 potentiometer on the PC Board until the voltmeter reads the calculated voltage ±1mV. You can also use a gas which does not contain O_2 and adjust RV2 potentiometer on the PC Board until the voltmeter reading is 0 mV ±1mV. The gas must be applied at the **room air filter**. Span Adjust: Apply Philips Calibration Gas M1660A (containing 52% O_2) to the room air filter (connect the calibration tubing to the open end of the room air filter). Calculate the correct voltage as described above using the specific O_2 concentration and measured barometric pressure. Adjust RV1 until the voltmeter reads the calculated voltage ±10 mV. Disconnect the calibration tubing from the room air filter. Reconnect cable of solenoid #2 if it was disconnected. If these adjustments are not successful, check the pneumatic system for leakages If the problem still persists, replace the O_2 sensor. If any adjustment was necessary, perform a Zero calibration followed by an O_2 Span calibration.
	Defective cables.	Check the cables connecting the O_2 assembly and the main PC board for signs of damage or wear. Check the connectors for damaged or loose connections. If any defects are apparent, replace the cable.
	Defective power supply	Carry out the checks for the power supply .
	Defective main PC board.	If the checks above do not solve the problem, replace the main PC board.

Optical Path Disgnostic Checks

Symptom	Possible Cause	Corrective Action
MeasOpticPath shows `Problem`	Defective or contaminated sample cell	Remove the sample cell and visually check it to see if it is contaminated. The inside of the cell should be smooth and shiny. If not, replace the sample cell. Wait after the first Zero Calibration to see whether the problem disappears. If problems are cleared after warm-up, but were present during warm-up, let the AGM run for at least 90 minutes after Power On to allow the unit to reach the 90 minutes zero. This is a special zero calibration where "new" zero constants for the next warm-up phase are stored. This prevents that problems are flagged during the next warm-up phase
	Defective IR measurement assembly head	Carry out the checks for the IR measurement assembly head . With the replacement head connected, check that Optical Path problem is no longer flagged. If the problem is gone, use a new head. If not, continue checks as described below.
	Defective power supply	Carry out the checks for the power supply .
	Defective main PC board	If the checks above do not solve the problem, replace the main PC board.

IR Measurement Assembly Diagnostic Checks

Symptom	Possible Cause	Corrective Action
Meas. Assy shows `Problem`	Defective IR measurement assembly head	Do the following IR measurement assembly head checks: Check whether Service Note M1026A-035/038 applies Remove the sample cell (see Chapter 7) and visually check it to see if it is contaminated. The inside of the cell should be smooth and shiny. Perform flow and Span gas calibration (in order to store new reference values) Using a voltmeter, check the IR source voltage as follows: Connect the voltmeter ground to TP1. Measure TP6 voltage. It should be 7.87V ±20mV. If this voltage is within limits, proceed to the next check. If not, adjust the potentiometer R178 to the required value. If the adjustment is not possible, replace the measurement assembly head. Power off. Connect a replacement head with the ribbon cable and reconnect the tubing. Turn power back on and see if the Meas. Assy still shows **`Problem`**. If the message is gone, replace the head. If the problem persists, continue checking.
	Defective power supply	Carry out the checks for the power supply .
	Defective cables	Check the cables connecting the measurement head and the main PC board for signs of damage or wear. Check the connectors for damaged or loose connections. If any defects are apparent, replace the cable.
	Defective main PC board	If the checks above do not solve the problem, replace the main PC board.

Agent ID Assmebly Diagnostic Checks

Symptom	Possible Cause	Corrective Action
Agt-ID. Assy shows `Problem`	Wrong Agent-ID software revision	Check for correct Agent-ID revision in AG Revision window, item: `Agt-ID SW` If necessary, replace Agent-ID EPROM.
	Defective agent ID head.	Do the following agent ID head checks: Using a voltmeter, check the IR source voltage at the main PC board as follows: Connect the voltmeter ground to TP1. Measure TP11 voltage. It should be 7.92V ±20mV. If this voltage is within limits, proceed to the next check. If not, adjust the potentiometer R180 to the required value. If adjustment is not possible, replace the Agent-ID head. Power off. Connect a replacement head with the ribbon cable and reconnect tubing. Turn power back on and see if the Agt.-Id still shows **`Problem`**. If the message is gone, replace the head. If the problem persists, continue checking. Power Supply Diagnostic Checks
	Defective power supply	Carry out the checks for the power supply .
	Defective cables	Check the cables connecting the measurement head and the main PC board for signs of damage or wear. Check the connectors for damaged or loose connections. If any defects are apparent, replace the cable.
	Defective main PC board	If the checks above do not solve the problem, replace the main PC board.

Power Supply Diagnostic Checks

Symptom	Possible Cause	Corrective Action
Power Supply shows `Problem`	Weak pump	If this Problem is flagged temporarily during a zero calibration or purge mode this could indicate a weak pump. Replace the pump if problem persists
	Defective power supply	Using a voltmeter, check the power supply voltages at the main PC board. The power supply connectors should carry the following voltages: TP14: +12V ±600 mV TP15: +5V ±250 mV TP16: -12V ±600 mV TP17: +12V ±600 mV TP18: Analog Ground If any of the above voltages are out of limits, carry out the checks again while systematically disconnecting the subassemblies (remember to power off the Module before removing cables and subassemblies). If the voltage(s) are still out of limits, replace the power supply.
	Defective cables	Check the cables connecting the measurement head and the main PC board for signs of damage or wear. Check the connectors for damaged or loose connections. If any defects are apparent, replace the cable.
	Defective main PC board	If the checks above do not solve the problem, replace the main PC board.

Operating Temperature Diagnostic Checks

Symptom	Possible Cause	Corrective Action
Oper. Temp. shows `Problem`	Defective fan	Check that the fan runs smoothly and check its cable. If necessary, replace fan or cable.
	Insufficient air circulation due to fan working inefficiently	Check the fan aperture for blockages or dust on the fan blade or guard. If necessary, unblock or clean the fan aperture.
	Operating environment for the module falls outside of specified limits	Do not operate the module in such an environment.
	Defective IR measurement assembly head	Follow its corrective action.
	Defective agent ID head	Follow its corrective action
	Defective power supply	Follow its corrective action
	Defective main PC board.	If the checks above do not solve the problem, replace the main PC board.

Test Points, Connectors and Jumpers

Test Points

The following table lists the test points; also refer to Figure 51.

Test Point	Description	Tolerance Value (±)
TP1	**Analog Gnd 1 (AGND1)**	
TP2	**Analog Dark Level Clamp (10DLCL)**	
TP3	**M1026A Preamp Signal**	**400mVpp ±30mv[1]**
TP4	**M1026A A/D Converter Input**	
TP5	**AC Pump Motor Reference (not used)**	
TP6	**IR source voltage for IR measurement assembly head (R178)**	**7.87 V ±20mv**
TP7	**Thermal Electric Cooler Drive Voltage to M1026A Head (TE+)**	**250mV ±100mV (after at least 15 min. warm-up)**
TP8	**Oxygen Transducer Signal Output (O_2SIG). Signal varies with O_2 concentration.**	**Examples: 20.8% O_2 is approx. 208mV, 50.0% O_2 is approx. 500mV**
TP9	**Analog Ground 2 (AGND2)**	

Test Point	Description	Tolerance Value (±)
TP10	**M1026A A/D Converter Input**	
TP11	**IR source voltage for agent ID head (R180)**	**7.92 V ±20mV**
TP13	**Isolated Ground for isolated RS-232 communications with the Host Computer via J14**	
TP14	**+12VHP**	**+12V ±600mV**
TP15	**+5V**	**+5V ±250mV**
TP16	**-12V**	**-12V ±600mV**
TP17	**+12V**	**+12V ±600mV**
TP18	**Analog Ground 3 (AGND3)**	

1. Measurement requires an oscilloscope.

Connectors

The following table lists the connectors on the main PCB.

Connector	Description
J1	IR Measurement Assembly Head
J2	Agent ID Head
J3	Factory use only
J4	Factory use only
J5	DC Power: pins 1&2: +12VHP, pins 3&4: +5V GND (DGND), pin 6: AGND, pin 7: AGND, pin 8: -12V, pin 9: +12V
J6	PC Board connector (also for NVRAM data transfer)
JP7	Top cover jumper
J8	Pump driver for DC pump and AC pump (DC PUMP/AC PUMP)[1]
J10	Oxygen Transducer Connection
J13	Factory use only
J14	Connection to Host Computer for communications, RS-232
J15	Fan power (FAN1)
J16	Not used
J17	Power LED
J19	Factory use only
J20	Factory use only
J21	O_2 Solenoid (SOL2)
J22	Optional Front Panel I/O

1. Use DC pump only.

Jumpers

The following table shows the correct jumper settings for the O_2 sensor (if installed).

Jumper	Paramagnetic O_2 Sensor	No O_2 Sensor
10IRQ1	OPEN	OPEN
10IRQ2	OPEN	OPEN
10IRQ3	CLOSED	OPEN

The top cover Jumper, JP7, must always be closed, whether or not the top cover is connected.

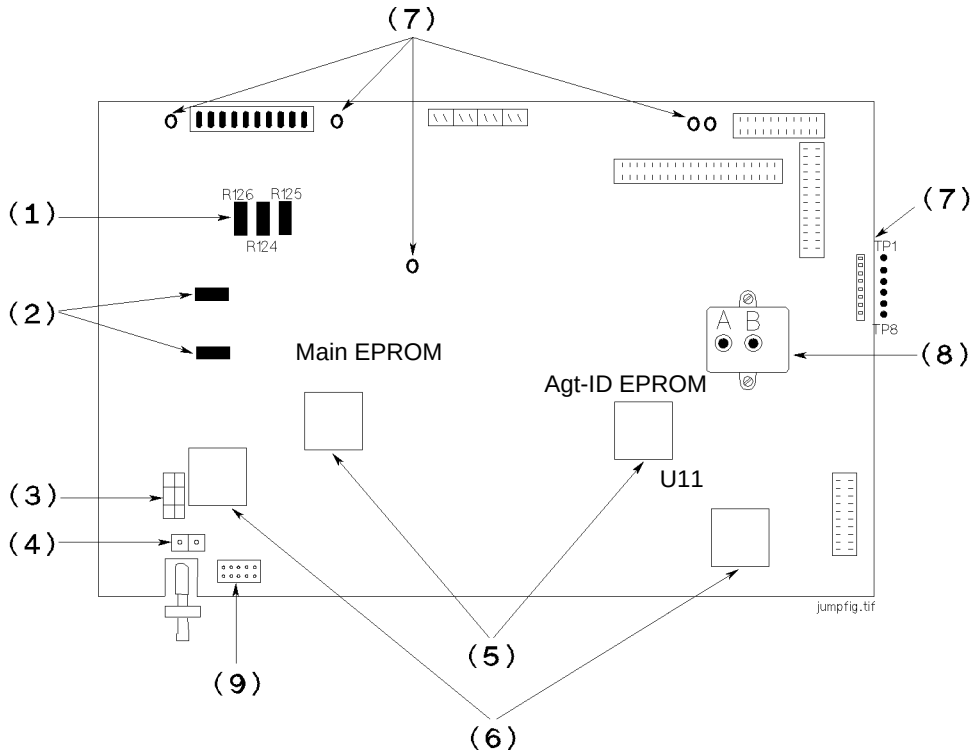


Figure 51 Potentiometers, Jumpers, and Test Points

Legend:

1	Flowrate potentiometers (R125, Purge flow and R126, Normal flow)
2	IR Source potentiometers (R178, R180)
3	O_2 jumper (10IRQ)
4	Top cover jumper (JP7)
5	EPROMs
6	Microprocessors
7	Test pins
8	Flow transducer
9	Top-cover PC board connector / NVRAM transfer

Repairing the Anesthetic Gas Module

Introduction

This section contains detailed removal and replacement procedures for all field-replaceable units in the Philips M1026A Anesthetic Gas Module.

CAUTION Use caution when handling tubing and other components of the patient circuit. Wear gloves, mask and gown while handling components that come into contact with the patient's exhalant gas or fluids.

Before you can remove any of these field replaceable units, you first need to remove the top cover of the Anesthetic Gas Module. The procedure for this is described in "The Top Cover" on page 230.

WARNING Switch off the instrument and disconnect it from the mains power supply. Take standard electrostatic precautions. For example, a wrist strap connected to electrical ground.

Figure 52 shows the field-replaceable units for the Anesthetic Gas Module. These are:

- Top Cover
- Infrared (IR) Measurement Assembly (2)
- Sample Cell
- Solenoid Valve #1 (7)
- Power Supply Unit (1)
- Main PC Board (13)
- O_2 Paramagnetic Assembly (11)
- Agent Identification Head (9)
- Pump (3)
- Fan (5)
- Solenoid Valve #2 (10)
- Top Cover PC Board (15)
- PM Kit comprising:
  - Room Air Filter (6)
  - Nafion® Tubing and internal bacterial filters(12)
  - Watertrap manifold seals
  - Pump Filter (4)

  Refer to Chapter 5 for removal and replacement details.
- Watertrap Manifold and Protector
- Power fuses

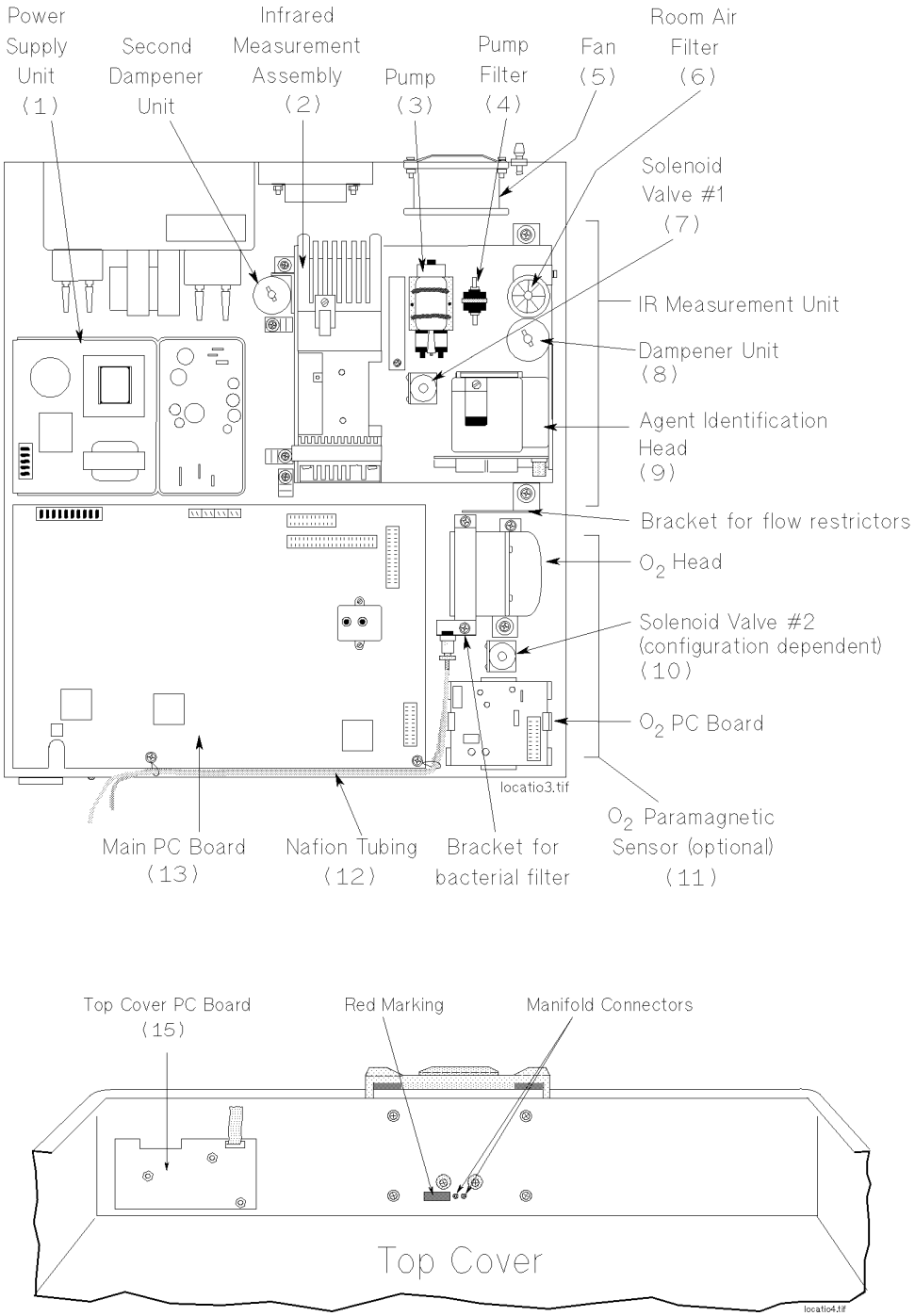


Figure 52 Main Subassemblies of the Anesthetic Gas Module

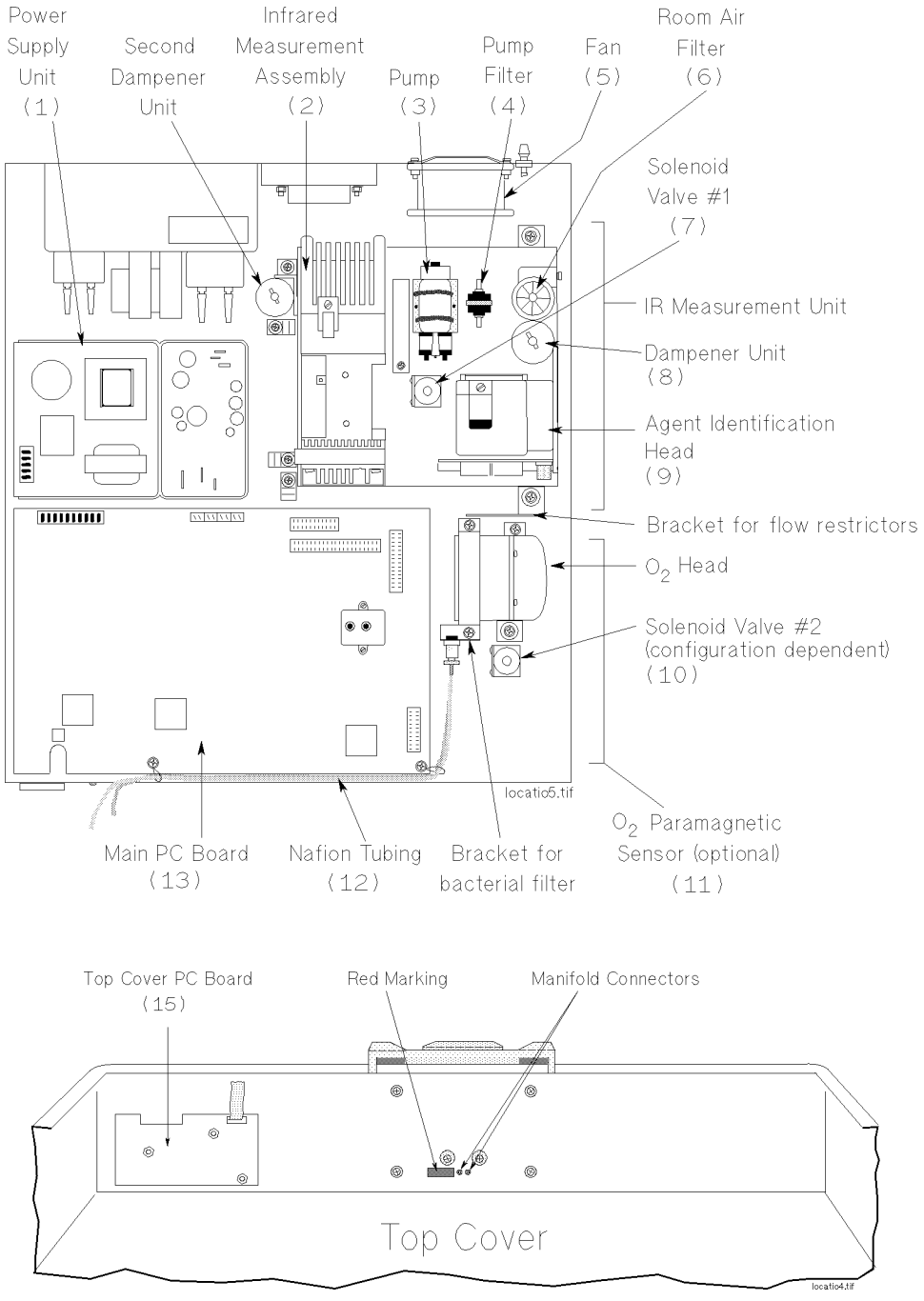


Figure 53 Main Subassemblies (showing O_2 paramagnetic sensor with integrated pc board) of the Anesthetic Gas Module

The Top Cover

Removal

To remove the top cover (refer to Figure 54 and Figure 55):

1 Make sure that the module is switched off and isolated from the mains power supply.

2 Remove the watertrap from the front of the cover (to avoid fluids in the watertrap reaching the water fuses when the cover is tipped).

3 Using a cross-tipped screwdriver, remove the 7 screws (1) securing the top cover to the body. These screws are located at the rear of the module and on the sides.

4 Slide the top cover (2) forward approximately 4cm.

NOTE At this stage, the top cover is still connected to the main PC board by a flat cable and the internal Nafion tubing.

5 Carefully lift the top cover until the flat cable connector (3) leading to the main PC board is accessible.

6 Remove the flat cable connector (3) from the top cover.

7 If necessary, remove the internal Nafion tubing.

8 Remove the top cover from the module.

Replacement

To replace the top cover (refer to Figure 56 and Figure 57):

1 Ensure that the module is switched off and isolated from the mains power supply.

2 Reconnect the flat cable connector (3).

3 If necessary, reconnect the internal Nafion tubing, following the given markings.

4 Carefully lower the top cover (4) onto the chassis (5).

5 Slide the top cover towards the rear of the module until the locating holes on the top cover are aligned with the threaded bores in the module.

6 Using a cross-tipped screwdriver, replace the 7 screws (1) securing the top cover to the module. The locating holes are under the top cover at the rear and sides of the module.

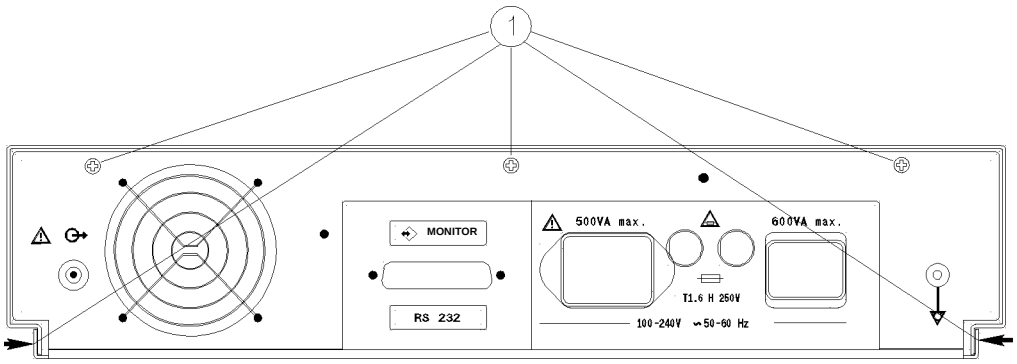


Figure 54 Top Cover Securing Screws for the Anesthetic Gas Module

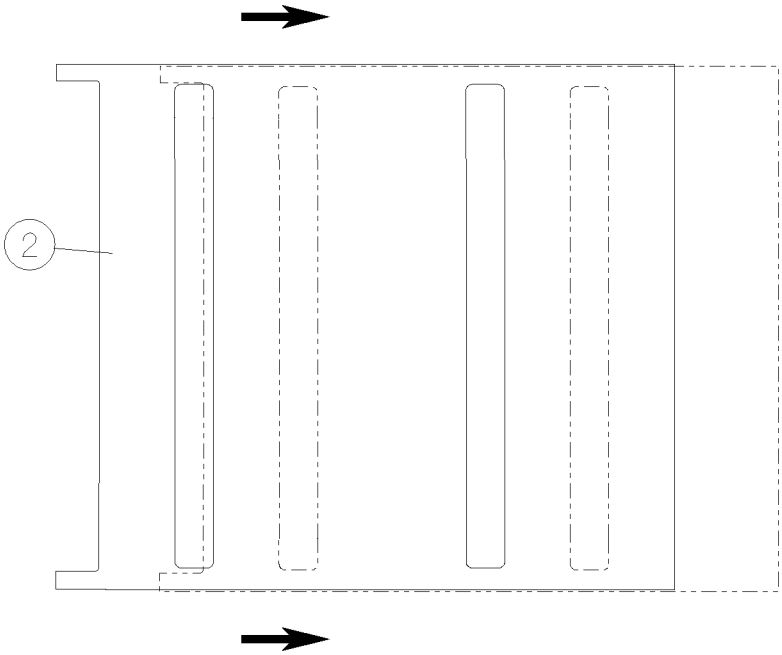


Figure 55 Sliding Off the Top Cover of the Anesthetic Gas Module

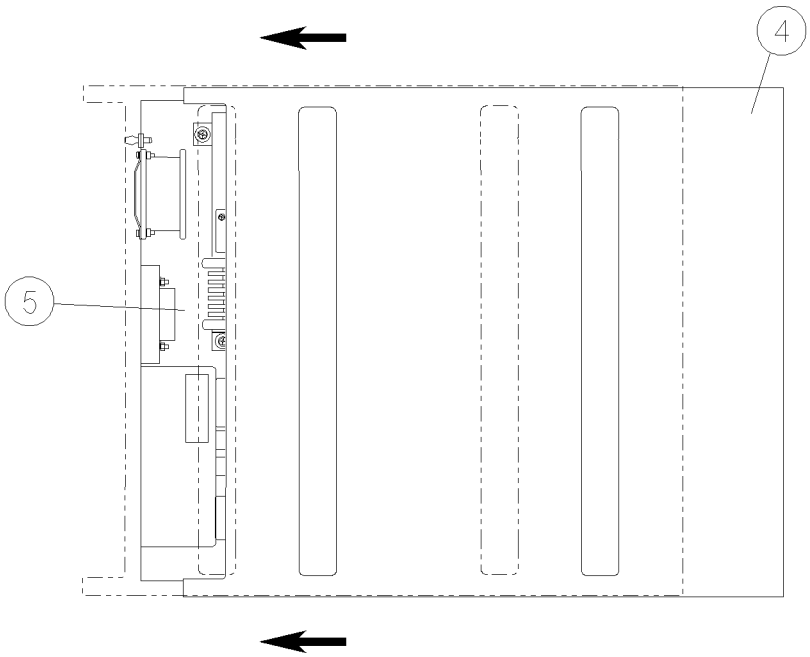


Figure 56 Sliding On the Top Cover of the Anesthetic Gas Module

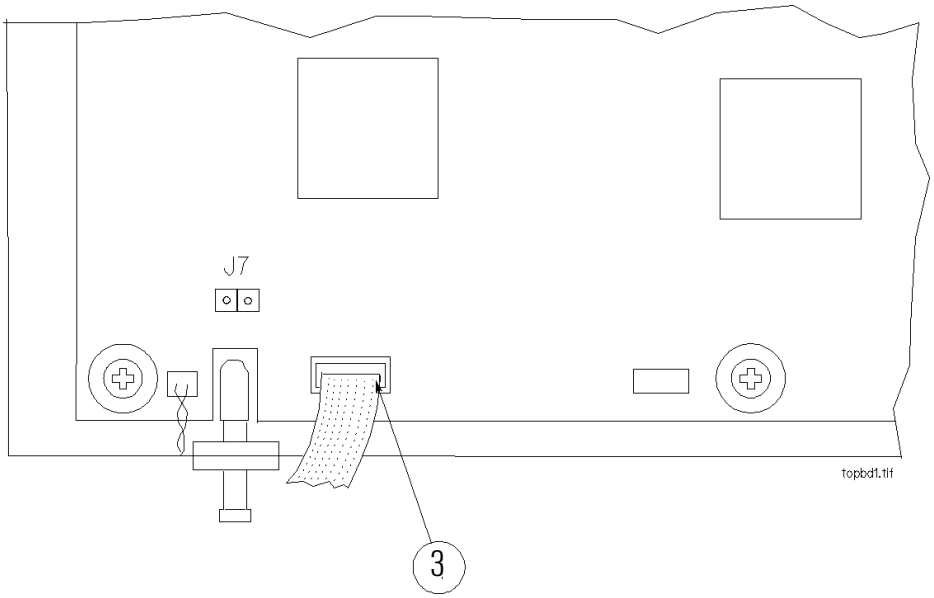


Figure 57 Main PC Board Connector to the Top Cover of the Anesthetic Gas Module

Lifting the IR Measurement Mounting Bracket

Several of the field replaceable subassemblies are mounted on the IR measurement mounting bracket, which is a subassembly of the Anesthetic Gas Module, as shown in Figure 58.

The IR assembly mounting bracket must first be lifted and stood on end before any of the following units can be removed or replaced:

- IR measurement assembly and sample cell.
- Solenoid valve #1.

Removal

To lift the IR Measurement mounting bracket (refer to Figure 58 and Figure 59):

1 Ensure that the module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the cables from the cable clip.

3 Remove the connection from the gas exhaust (1).

4 Using a cross-tipped screwdriver, remove the four screws and lock washers (2) securing the IR Measurement mounting bracket to the module.

5 Lift the IR Measurement mounting bracket and stand it carefully on its end, so that the ribbon cables are at the bottom. The securing screws on the underside are now accessible, as shown in Figure 59.

Replacement

To replace the IR Measurement mounting bracket (refer to Figure 58 and Figure 59):

1 Ensure that the module is switched off and isolated from the mains power supply.

2 Lay the IR Measurement mounting bracket carefully onto its 4 spacers so that the locating holes are aligned with the threaded bores.

3 Make sure that the dampener (3), cable clamp (4) and bracket with flow restrictor (5) are in place. Using a cross-tipped screwdriver, fit the four screws and lock washers (2) securing the IR Measurement mounting bracket to the module.

4 Reconnect the pneumatic tubing to the gas exhaust (1).

5 Replace the power connection to the pump (where applicable) and secure the cables with the clip.

6 Replace the top cover of the module.

NOTE After replacing the IR Measurement mounting bracket, check that all flat-cable connectors are firmly seated and show no signs of damage.

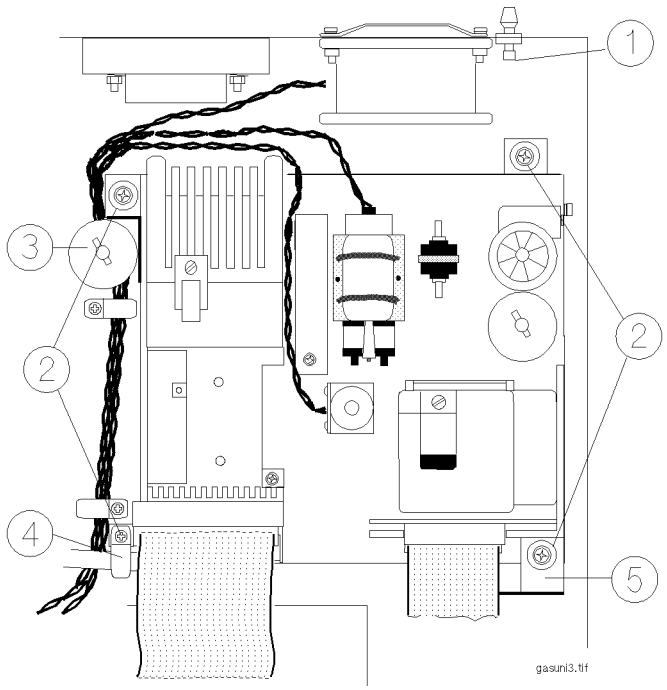


Figure 58 Lifting the IR Measurement Mounting Bracket

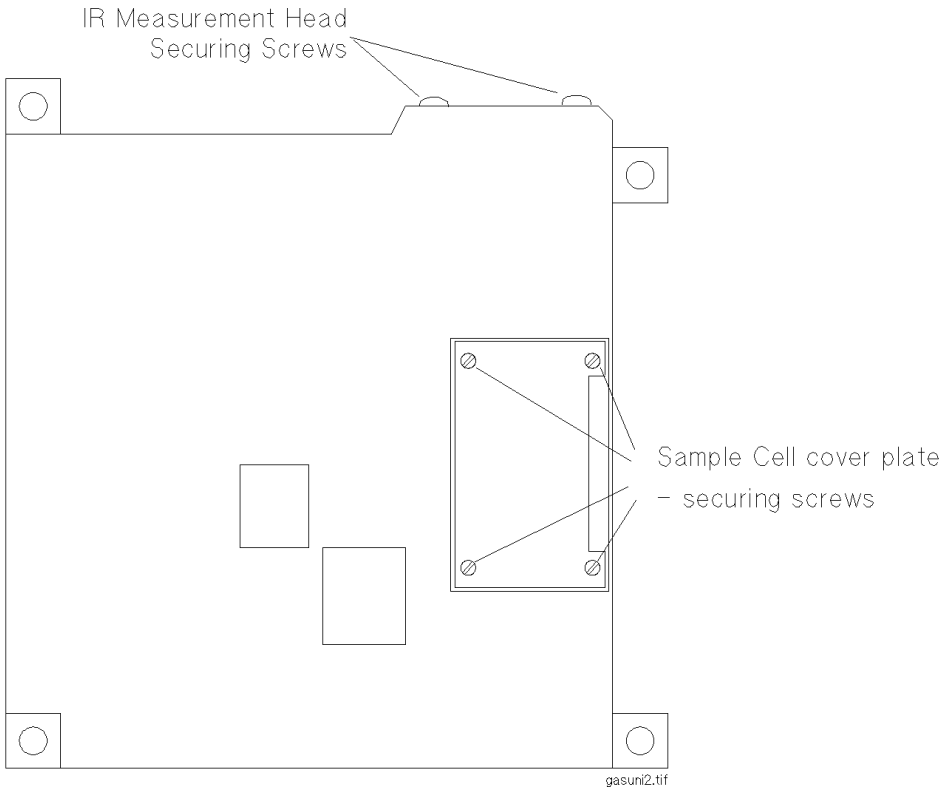


Figure 59 Underside of the IR Measurement Mounting Bracket

Infrared Measurement Assembly Head

Transferring NVRAM Data to a Replacement Head

When you replace an IR measurement head, you need to transfer its data to the replacement head. The data is stored in non-volatile RAM (NVRAM) on the head and includes:

- System serial number
- Pump hours
- Flow rate limits
- User span constant for all channels
- User O_2 calibration values
- O_2 delay cycles
- IR source voltage

The NVRAM transfer board (NTB) reads data from the old head and transfers it to the replacement head. The NTB is included with each replacement head.

Procedure for Transferring Data

1 Disconnect the Anesthetic Gas Module from the monitor.

2 Turn off power to the Anesthetic Gas Module.

3 Remove the Anesthetic Gas Module top cover and disconnect it from the Main PC board.

4 Connect the 40-pin cable of the NTB to the 40-pin connector of the new replacement IR Measurement head.

5 Connect the 10-pin cable of the NTB to the top cover connector (J6) on the Main PC board.

6 Power up the Anesthetic Gas Module and observe the LED on the NTB.

7 For about the first 5 seconds the LED on the NTB will be *amber*. Whenever the LED is amber, the NTB is processing information and you must stand by until the LED changes color again. During these first 5 seconds, the NVRAMs of both the old and the new measurement heads are being read and checked. If the LED changes to a solid *green* color, the NVRAM transfer process can begin. Please skip to step 8 if the LED is *green*.

When either NVRAM cannot be read, it may take up to one minute before the LED changes color and you will observe one of two error conditions:

– If the LED changes to a solid *red* color, a problem reading the old measurement head has occurred. Turn off the power and check all connections. Make sure the ribbon cables are not broken and correctly seated. Repeat the procedure staring with step 6.

If the LED is still on *red*, proceed with the installation of the new analyzer head regardless. The NVRAM transfer will not be possible, but the replacement head has default information for pump hours and no serial number. However, before installing the new measurement head, you need to verify that the head is functional:

a. Replace the old measurement head with the new one.

b. Repeat the NVRAM transfer procedure from step 6.

If the LED blinks alternately *red* and *green*, the head is functional and you can continue with the installation of the new head. If the LED is solid *red*, either the new head and/or the cable from

the head to the main PC board is defective. In this case you must replace the head or the cable or both.

NOTE When installing a new measurement head and using the default NVRAM data, a flow rate calibration *must* be performed because no flow rates will be transferred. If no flow rate calibration is performed, a problem with the pneumatic system will be flagged during Anesthetic Gas Module operation.

– If the LED blinks alternately *red* and *green*, a problem occurred reading the new analyzer head. Turn off the power and check all connections. Make sure the ribbon cables are not broken and correctly seated. Repeat the procedure staring with step 6.

If the LED is still blinking *red* and *green* you need to check whether the failed NVRAM transfer is due to a defective NTB and/or cable connection:

a. Replace the old measurement head with the new one.

b. Repeat the NVRAM transfer procedure from step 6.

If the LED is solid *red*, the new measurement head is defective. In this case you must use a new replacement measurement head and return to step 4. If the LED blinks alternately *green* and *red*, the NTB and/or the attached cables are defective. In this case you need to use a new NTB, or you can install the new measurement head with the default NVRAM data.

8 Once the LED is on *green*, you can begin the NVRAM transfer process by pressing the momentary push button switch on the NTB. The LED will change to *amber* for about 5 seconds, followed by solid *green* indicating a good transfer of NVRAM data.

If you observe a blinking *red* LED, no transfer or a bad transfer of NVRAM data occurred. Proceed with the installation of the new measurement head regardless. The NVRAM transfer will not be possible, but the replacement head has default information for pump hours and no serial number. However, a flow rate calibration ***must*** be performed because no flow rates will be transferred. If no flow rate calibration is performed, a problem with the pneumatic system will be flagged during Anesthetic Gas Module operation.

9 If step 8 was successful, the Anesthetic Gas Module can now be powered off. The NTB can be disconnected and the old measurement head removed and replaced with the new head (see removal and replacement procedure below).

10 Reconnect the Anesthetic Gas Module to the monitor.

NOTE When returning the defective measurement head for repair, make sure to return the NVRAM transfer board with the head.

Instructions for the transfer procedure are also included with the NTB.

Removal

To remove the IR measurement assembly head (refer to Figure 60 and Figure 61):

1 Remove the flat-cable (1) connector from the main PC board.

2 Remove the pneumatic connections (2) from the sample cell, which are located on top of the IR measurement assembly head.

3 Remove the pressure transducer connection (3) located on the side of the IR measurement assembly head.

4 Stand the IR measurement mounting bracket on end (refer to "Lifting the IR Measurement Mounting Bracket" on page 233).

5 Using a cross-tipped screwdriver, remove the 3 screws (4) securing the IR measurement assembly head to the IR measurement mounting bracket.

6 Remove the IR measurement assembly head carefully from the IR measurement mounting bracket.

Replacement

To replace the IR measurement assembly head (refer to Figure 60 and Figure 61):

1 Place the IR measurement assembly head in the IR measurement mounting bracket so that the threaded bores on the head align with their corresponding locating holes on the IR measurement mounting bracket.

2 Using a cross-tipped screwdriver, replace the three screws (4) securing the IR measurement assembly head to the IR measurement mounting bracket.

3 Replace the IR measurement mounting bracket (refer to "Lifting the IR Measurement Mounting Bracket" on page 233).

4 Replace the transducer reference connection (3) located on the side of the IR measurement assembly head.

5 Replace the pneumatic connections (2) to the sample cell (located on top of the IR measurement assembly head).

NOTE Check that all tubing is tightly connected and show no signs of damage.

6 Replace the flat-cable (1) connector to the main PC board.

NOTE After replacing the IR measurement assembly head, check that all flat-cable connectors are firmly seated and show no signs of damage.

Now perform the performance checks described in the "Test and Inspection Matrix" on page 262.

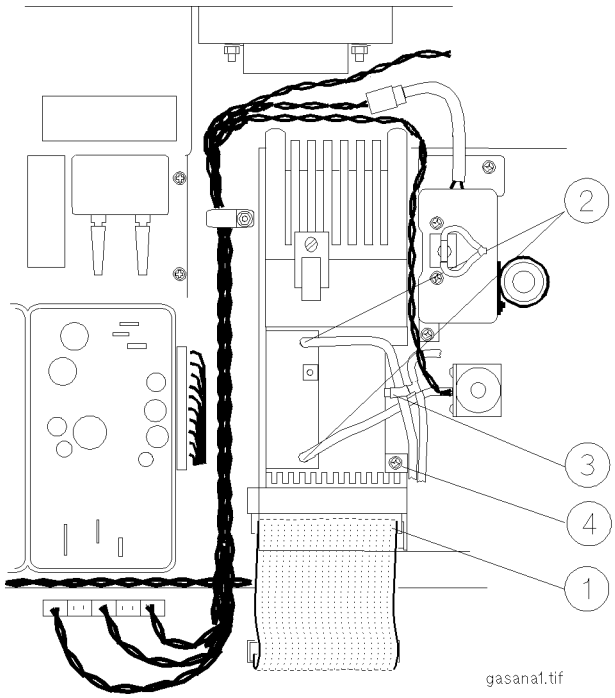


Figure 60 Removing the IR Measurement Assembly Head

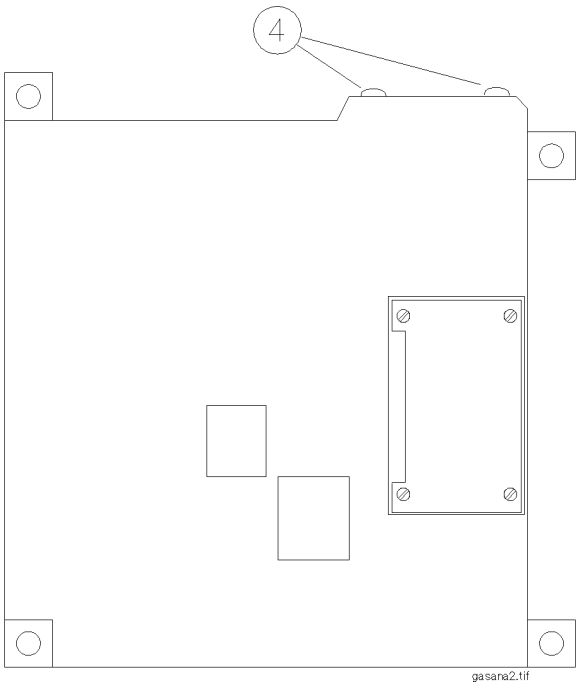


Figure 61 Locating Screws for the IR Measurement Assembly Head

Sample Cell

Removal

To remove the sample cell (refer to Figure 62, Figure 63, Figure 64 and Figure 65):

1 Stand the IR measurement mounting bracket on end, towards the main PC board (refer to "Lifting the IR Measurement Mounting Bracket" on page 233).

2 Remove the pneumatic connections (1) from the sample cell, which are located on top of the IR measurement assembly head.

3 Using a cross-tipped screwdriver, remove the four screws (2) securing the sample cell cover plate and bracket (3) from the IR measurement assembly head. Retain these parts for later replacement.

4 Lay the IR measurement assembly head flat and, using a flat-tipped screwdriver, apply pressure from above to the overlapping part (4) of the sample cell cover, and pry it off.

5 Carefully withdraw the sample cover and bracket (5) from the IR measurement head.

6 Using a cross-tipped screwdriver, remove the screw (6) securing the clamping plate (7) to the sample cell bracket (8).

7 Remove the sample cell (9).

Replacement

To replace the sample cell (refer to Figure 62, Figure 63, Figure 64 and Figure 65):

1 Position the sample cell (9) onto its bracket (8) and hold it in place with the clamping plate (7).

2 Using a cross-tipped screwdriver, replace the screw (6) securing the clamping plate to the bracket. Before tightening the screw, ensure that the pipes to the sample cell are aligned parallel with the sides of the bracket.

NOTE Make sure the temperature sensor has not slipped out of its hole. This can prevent the bracket from being pushed home.

3 Insert the sample cell bracket and cover (5) into the base of the IR measurement assembly head. Push the bracket home so that the surface of the cover plate is flush with the base of the IR measurement head. The two gas tubes should now protrude from the holes (1) on top of the IR measurement head.

4 Using a cross-tipped screwdriver, replace the four screws (2) securing the sample cell cover plate and bracket (3) to the IR measurement assembly head.

5 Replace the pneumatic connections (1) to the sample cell, which are located on top of the IR measurement head.

NOTE Check that all tubing is tightly connected and show no signs of damage.

6 Replace the IR measurement mounting bracket (refer to "Lifting the IR Measurement Mounting Bracket" on page 233).

NOTE After replacing the sample cell, check that all flat-cable connectors are firmly seated and show no signs of damage.

Now perform the performance checks described in the “Test and Inspection Matrix” on page 262.

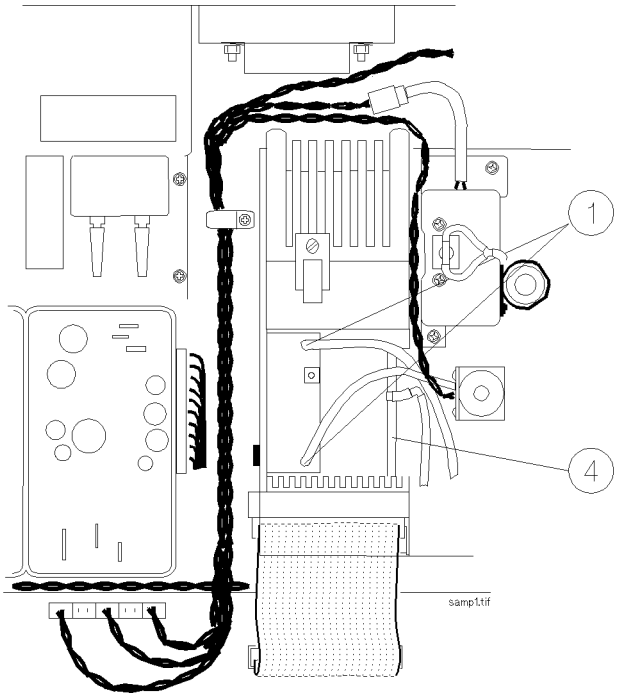


Figure 62 Removing the Sample Cell Pneumatic Connections

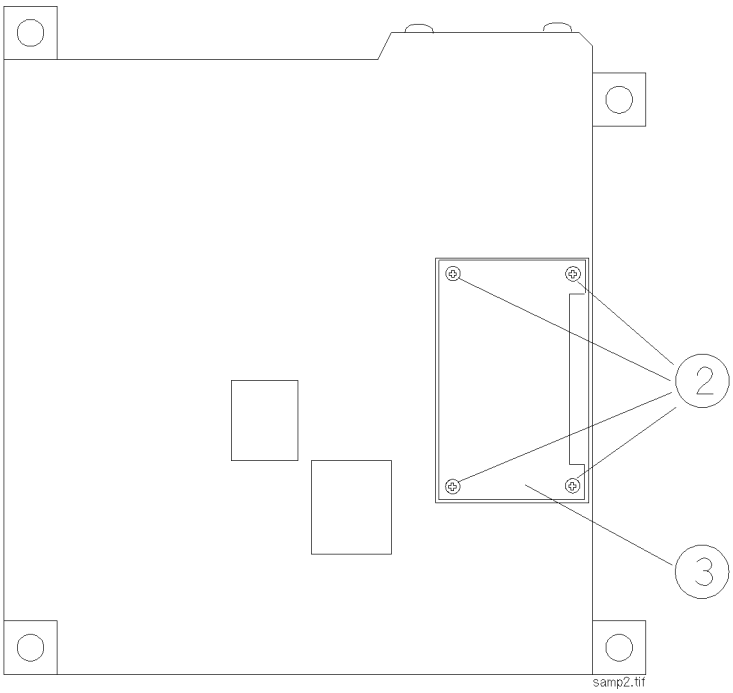


Figure 63 Removing the Sample Cell Cover

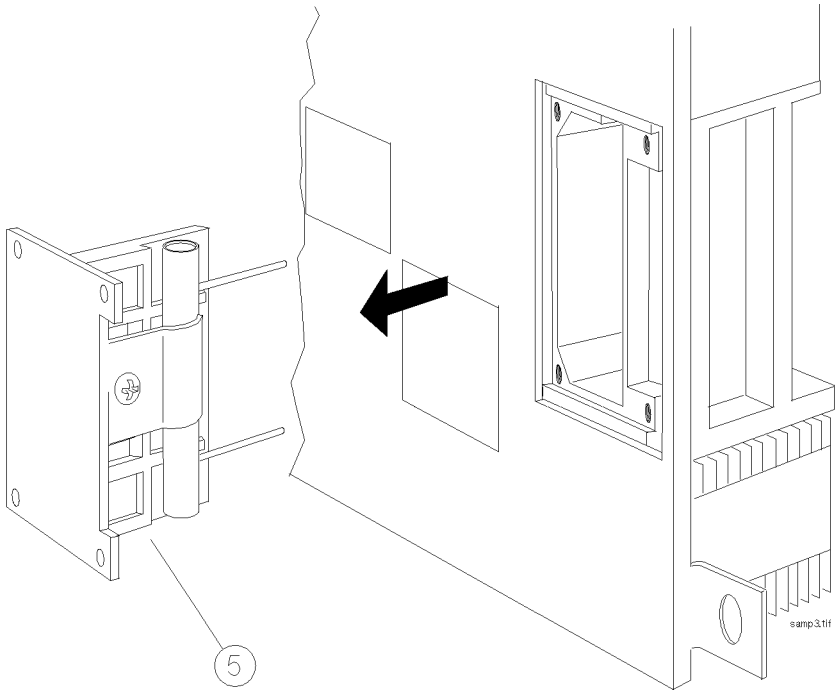


Figure 64 Extracting the Sample Cell Bracket

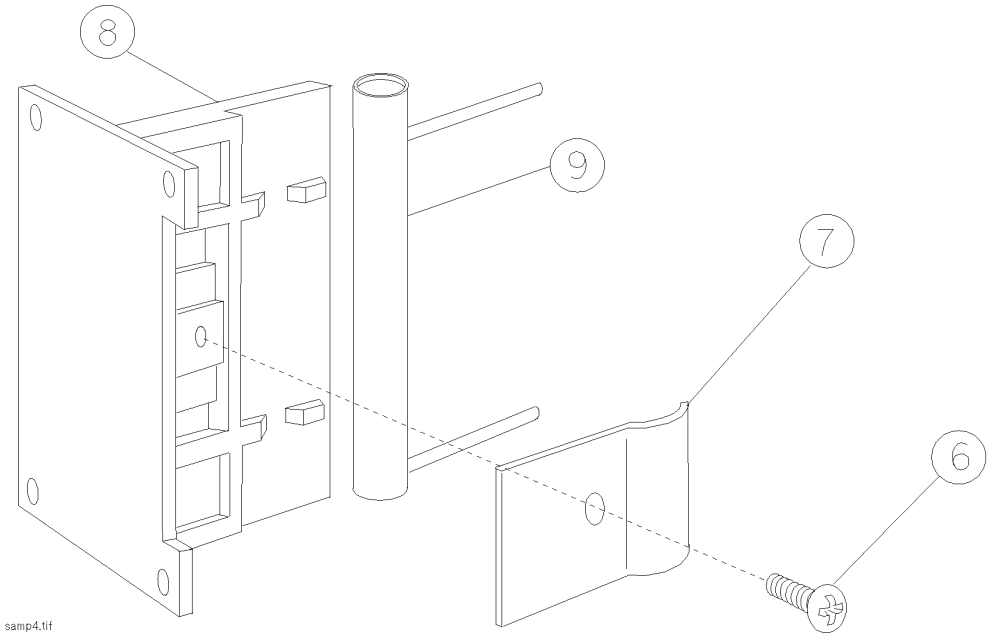


Figure 65 Replacing the Sample Cell

Solenoid Valve #1

Removal

To remove solenoid valve #1 (refer to Figure 66 and Figure 67):

1 Remove the pneumatic tubing (1) from solenoid valve #1.

2 Remove the power connector (2) from the main PC board.

3 Pry the twisted pair supplying power from the solenoid valve out of the cable clip (3).

4 Using a cross-tipped screwdriver, remove the three screws (4) securing the IR measurement assembly head.

5 Lift the IR measurement head slightly so that the screws (5) securing the solenoid valve are accessible.

6 Using a cross-tipped screwdriver, remove the two screws securing solenoid valve #1 to the IR measurement mounting bracket.

7 Carefully remove solenoid valve #1 and its cable from the IR measurement mounting bracket.

Replacement

To replace solenoid valve #1 (refer to Figure 66 and Figure 67):

1 Lift the IR measurement assembly head slightly so that the threaded bores (5) on the mounting bracket for the solenoid valve are accessible.

2 Carefully position Solenoid Valve #1 so that its locating holes align with the threaded bores on the mounting bracket.

3 Using a cross-tipped screwdriver, replace the two screws (5) securing Solenoid Valve #1 to the IR measurement mounting bracket.

4 Snap the twisted pair from the solenoid valve into the cable clip (3) securing the twisted pairs that connect the IR measurement assembly head to the main PC board.

5 Replace the connection (2) to the main PC board.

6 Replace the pneumatic tubing (1) to Solenoid Valve #1.

NOTE Check that all tubing is tightly connected and show no signs of damage.

After replacing Solenoid Valve #1, check that all flat-cable connectors are firmly seated and show no signs of damage.

7 Using a cross-tipped screwdriver, replace the three screws (4) securing the IR measurement assembly head.

8 Replace the IR measurement assembly mounting bracket (refer to “Lifting the IR Measurement Mounting Bracket” on page 233).

Now perform the performance checks described in the “Test and Inspection Matrix” on page 262.

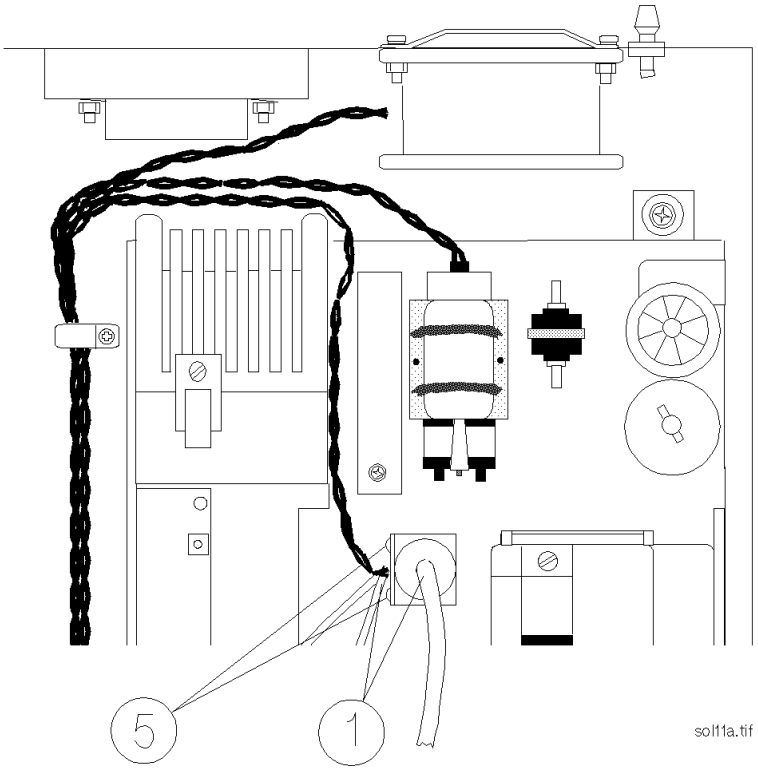


Figure 66 Removing the Solenoid Valve #1

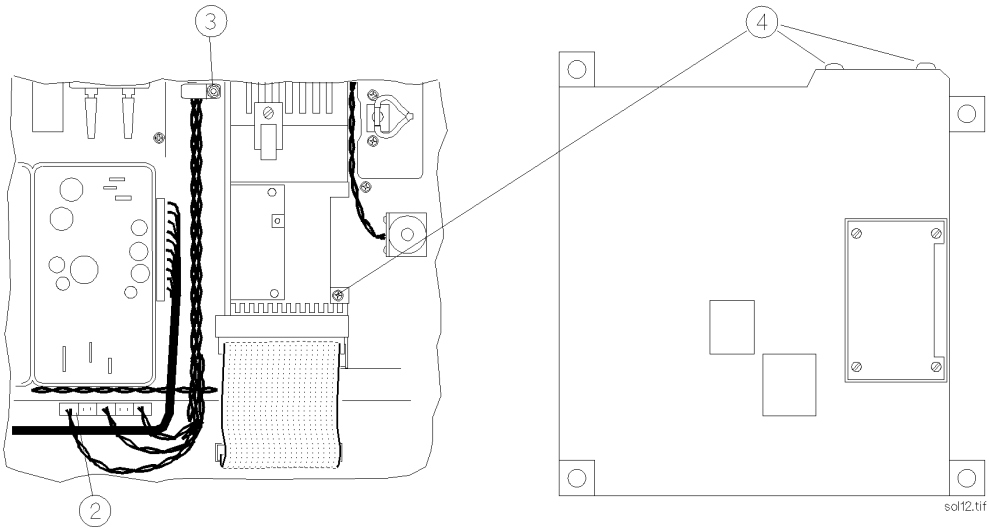


Figure 67 Replacing the Solenoid Valve #1

Power Supply Unit

Removal

To remove the power supply unit (refer to Figure 68):

1 Ensure that the module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the ac power connector (1) from the power supply unit.

3 Remove the power connector (2) from the main PC board.

4 Using a cross-tipped screwdriver, remove the four screws (3) securing the power supply unit to its mounting.

5 Remove the power supply unit.

Replacement

To replace the power supply unit (refer to Figure 68):

1 Ensure that the module is switched off and isolated from the mains power supply.

2 Carefully place the power supply unit so that its locating holes are aligned with the threaded bores in the mounting on the module.

3 Using a cross-tipped screwdriver, replace the four screws (3) securing the power supply unit to its mounting.

4 Connect the power connector (2) to the main PC board.

5 Connect the ac power connector (1) to the power supply unit.

6 Replace the top cover of the module.

Now perform the performance checks described in the “Test and Inspection Matrix” on page 262.

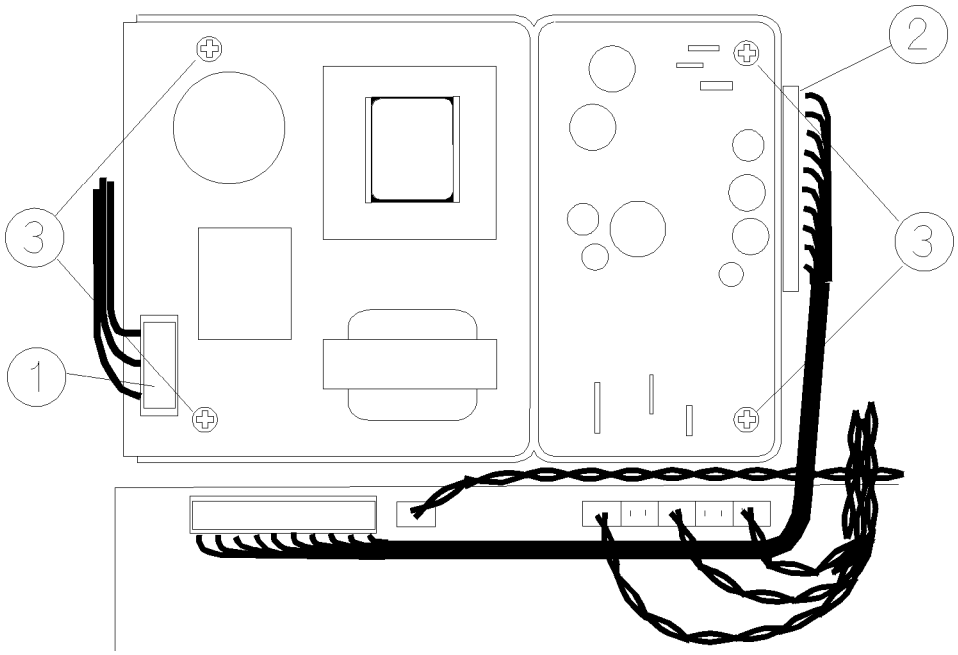


Figure 68 Removing and Replacing the Power Supply Unit

Main PC Board

Removal

To remove the main PC board (refer to Figure 69):

1 Ensure that the Module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the pneumatics tubing from the pressure transducer (1).

3 Remove the main PC board connector (2) from the power supply unit.

4 Remove the power connectors (3) that connect the main PC board to the fan, solenoid valve #1, pump and solenoid valve #2.

5 Remove the flat-cable connector (4) from the IR measurement head.

6 Remove the flat-cable connector (5) from the RS232 connector.

7 Remove the flat-cable connector (6) from the agent identification head.

8 If O_2 sensor is present, remove the flat-cable connector (7) from the small O_2 sensor PC board (or directly from the O_2 sensor, for sensors with integrated PC board).

9 Remove the connector (9) from the power LED.

10 Using a cross-tipped screwdriver, remove the cable clamps (12).

11 Using a cross-tipped screwdriver, remove the 6 screws (10) securing the main PC board to its mounting on the module.

12 Carefully remove the main PC board.

Replacement

To replace the main PC board (refer to Figure 69):

1 Ensure that the module is switched off and isolated from the mains power supply.

2 Carefully place the main PC board on its mounting in the Anesthetic Gas Module so that the 6 locating holes are aligned with the threaded bores.

3 Using a cross-tipped screwdriver, replace the 6 screws and washers (10) securing the main PC board to its mounting, and replace the cable clamps.

4 Replace the connector (9) to the power LED.

5 If the O_2 sensor is present, replace the flat-cable connector (7) to the O_2 sensor PC board (or directly to the O_2 sensor). Verify the O_2 jumper settings as described in “Jumpers” on page 103.

6 Replace the flat-cable connector (6) to the agent ID head.

7 Replace the flat-cable connector (5) to the RS232 connector.

8 Replace the flat-cable connector (4) to the IR measurement head.

9 Replace the power connectors (3) that connect the main PC board to the fan, pump, solenoid #1 and solenoid #2.

10 Replace the main PC board connector (2) to the power supply unit.

11 Refit the pneumatic tubing to the pressure transducer (1). Check that all tubing is tightly connected and show no signs of damage.

12 Replace the top-cover cable (8) to the PC board.

NOTE After replacing the main PC board, check that all flat-cable connectors are firmly seated and show no signs of damage.

Verify the O_2 jumper settings as described in “Jumpers” on page 225.

Make a flowrate check as described in “Performance Flowrate Check” on page 55.

13 Replace the top cover of the module. Ensure that the top cover jumper (JP7) is set to “closed”.

14 Do a configuration check in service mode (Agent-ID, O_2 sensor).

Now perform the performance checks described in the “Test and Inspection Matrix” on page 262.

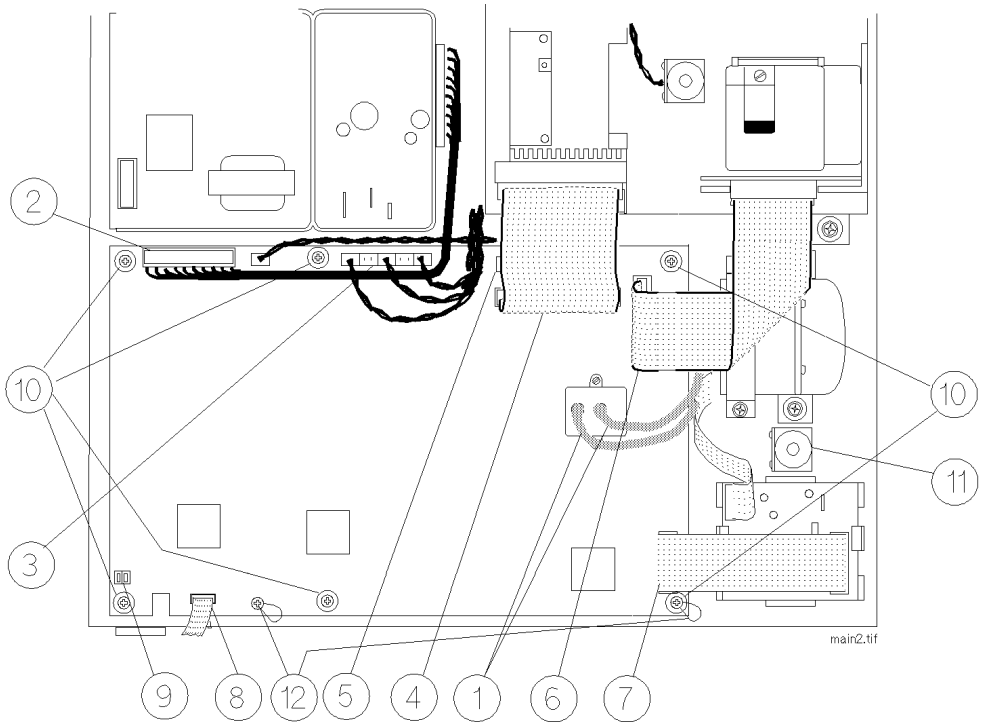


Figure 69 Removing the Main PC Board

O_2 Sensor

The O_2 sensor is always replaced together with the small PC board that controls it. The newer O_2 sensors have the board integrated inside the sensor housing.

Removal

To remove the O_2 sensor and its PC board follow the steps marked (a) and to remove the O_2 sensor with integrated PC board follow the steps marked (b) (refer to Figure 70 and Figure 71):

1 Ensure that the module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the 3 pneumatic connections (1) from the O_2 sensor.

3 Remove the flat cable connector (2) from the PC board that controls the O_2 sensor.

4 Remove the flat cable connector (2) from the connector on the top of the O_2 sensor housing.

5 Release the clips (3) securing the PC board to its mounting.

6 Using a cross-tipped screwdriver, remove the two screws and washers (4) securing the O_2 sensor to its mounting brackets.

7 Carefully remove the O_2 sensor [(b) along with its PC board.]

NOTE If you are not operating O_2, remove the appropriate jumper as described in “Jumpers” on page 103.

Replacement

To replace the O_2 sensor and its PC board follow the steps marked (a) and to replace the O_2 sensor with integrated PC board follow the steps marked (b) (refer to Figure 70 and Figure 71):

1 Ensure that the module is switched off and isolated from the mains power supply.

2 Carefully place the O_2 sensor on its mounting so that the locating holes are aligned with the threaded bores.

3 Press the PC board onto its mounting until it clicks into place, and is firmly secured by the clips (3).

NOTE Make sure that the PC board is inserted so that the smaller connector points toward the main PC board.

1 Place the bracket with the internal bacterial filters (5) onto the mounting bracket, aligning the locating holes.

2 Using a cross-tipped screwdriver, replace the two screws and washers (4) securing the O_2 sensor to its mounting.

3 Replace the flat cable connector (2) that connects the main PC board to the PC board that controls the O_2 sensor.

4 Replace the flat cable connection (2) to the top of the O_2 sensor housing.

NOTE Verify the O_2 jumper settings.

5 Replace the 3 pneumatic connections (1) to the O_2 sensor. Connect the tubing with the T-piece to the O_2 sensor inlets (upper and lower connections). Connect the single tubing to the outlet (middle connection). Check that all tubing is tightly connected and show no signs of damage.

NOTE After replacing the O_2 sensor and, where applicable, its controlling PC board, check that all flat-cable connectors are firmly seated and show no signs of damage.

6 Replace the top cover of the module.

Now perform the performance checks described in the “Test and Inspection Matrix” on page 262.

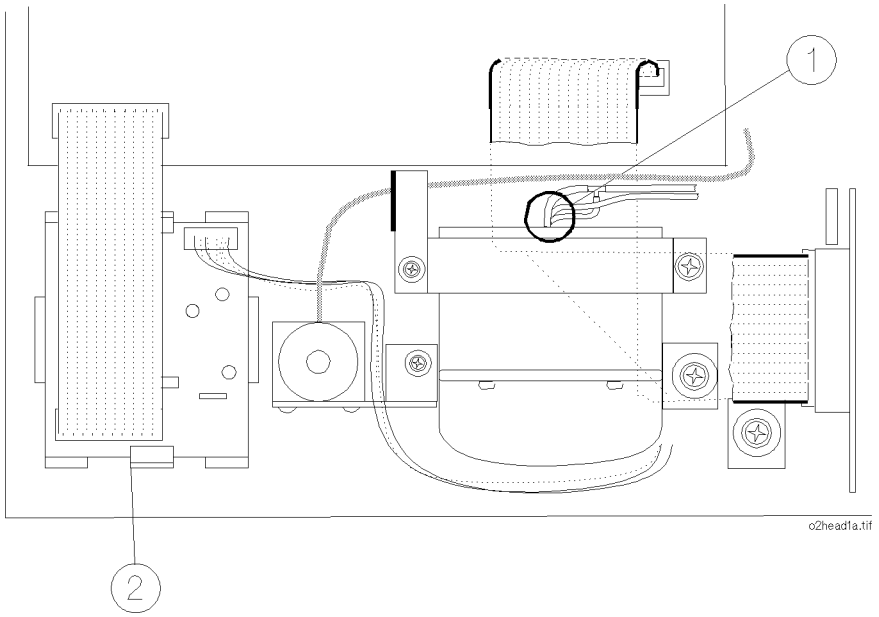


Figure 70 Removing the Connections of the O_2 Sensor

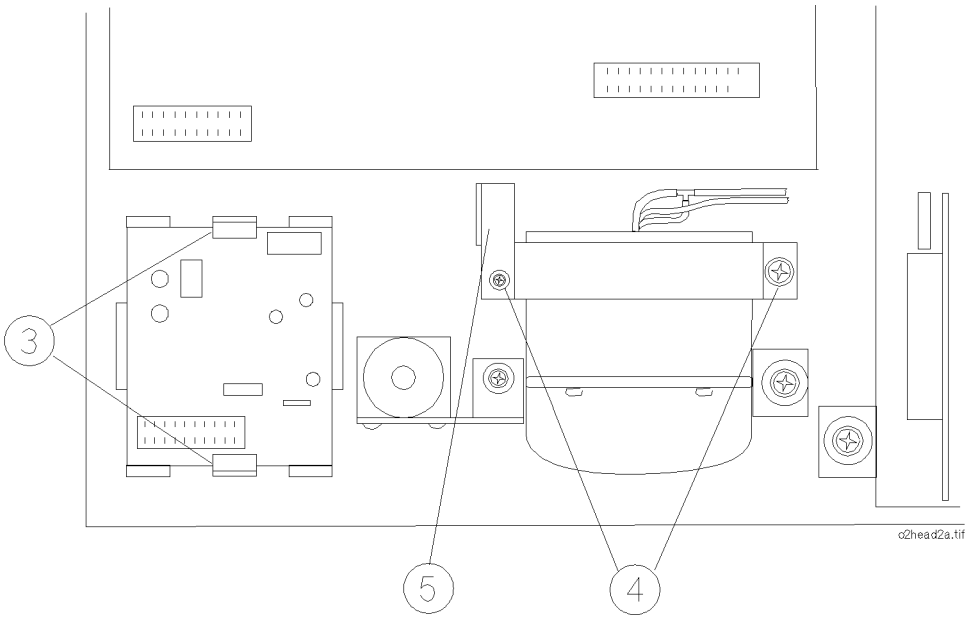


Figure 71 Removing the O_2 Sensor with its PC Board

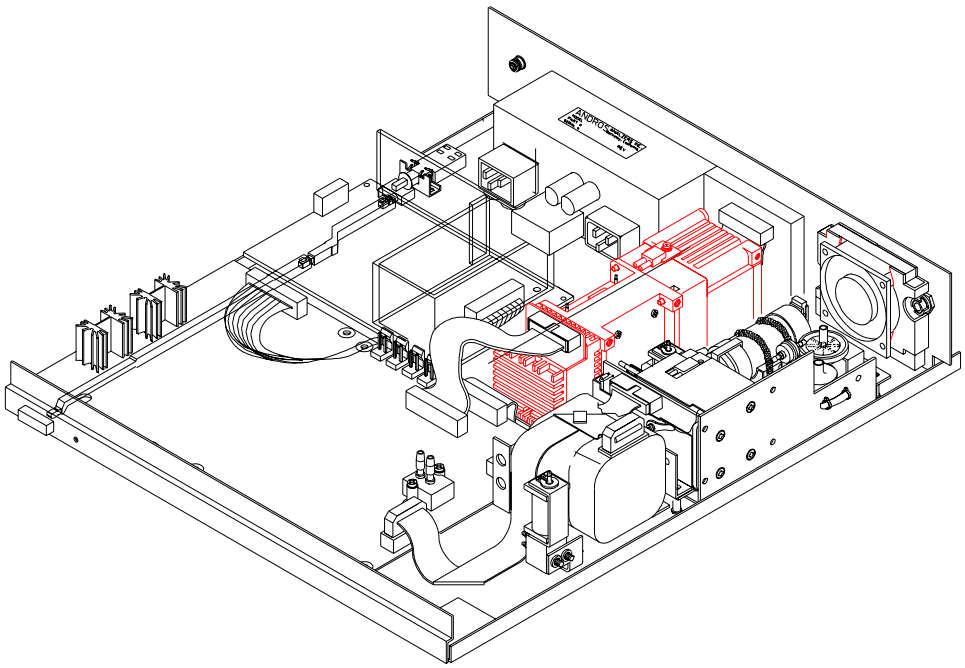


Figure 72 Layout showing O_2 sensor with Integrated PC Board

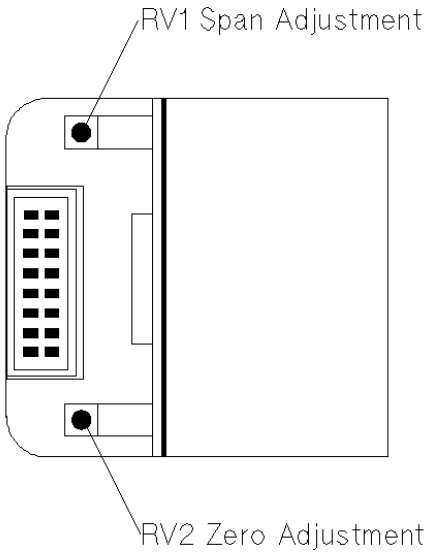


Figure 73 Location of Adjustment Potentiometers on O_2 Sensor with Integrated PC Board

Agent Identification Head

Removal

To remove the agent ID head (refer to Figure 74):

1 Ensure that the module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the flat cable connection (1) from the Agent-ID.

3 Remove the 3 pneumatic connections (2) from the side of the agent ID head.

4 Using a cross-tipped screwdriver, remove the 4 screws (3) securing the agent ID head to the IR measurement mounting bracket.

5 Carefully remove the agent ID head from the module.

Replacement

To replace the agent ID head (refer to Figure 74):

1 Place the agent ID head onto the IR measurement unit so that its threaded bores align with the locating holes provided.

2 Replace the 3 pneumatic connections (2) to the side of the agent ID head. The top and bottom connections are the inlets, and the middle connection is the outlet to the pump. Check that all tubing is tightly connected and show no signs of damage.

3 Using a cross-tipped screwdriver, replace the 4 screws (3) securing the agent ID head to the IR measurement mounting bracket.

4 Replace the flat cable connection (1) to the Agent-ID.

NOTE After replacing the agent ID head, check that all flat-cable connectors are firmly seated and show no signs of damage.

5 Replace the top cover of the module.

Now perform the performance checks described in the “Test and Inspection Matrix” on page 262.

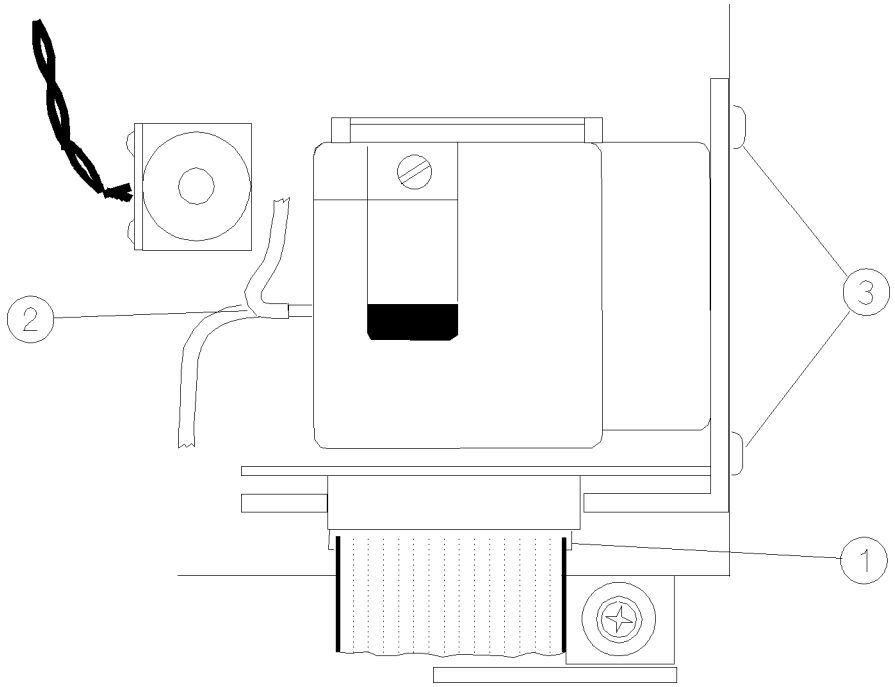


Figure 74 Removing and Replacing the Agent ID Head

Pump

Removal

To remove the pump (refer to Figure 75):

1 Ensure that the module is switched off and isolated from the mains power supply. Remove the cover of the module.

2 Remove the pneumatic connections (1) and/or (4) from the pump.

3 Remove the power connection from the main PC board (2).

4 Using a cross-tipped screwdriver, remove the two screws and washers (3) securing the pump to the IR measurement mounting bracket.

5 Carefully slide out the pump from the IR measurement mounting bracket.

Replacement

To replace the pump (refer to Figure 75):

1 Carefully position the pump so that the threaded bores in the pump align with the locating holes on the IR measurement mounting bracket.

2 Using a cross-tipped screwdriver, replace the two screws and washers (3) securing the pump to the IR measurement mounting bracket.

3 Replace the connection (2) to the main PC board (to the dc pump connector).

4 Replace the pneumatic connections (1) and/or (4) to the pump. Check that all tubing is tightly connected and show no signs of damage.

NOTE After replacing the pump, check that all flat-cable connectors are firmly seated and show no signs of damage.

5 Replace the top cover of the module.

Now perform the performance checks described in the "Test and Inspection Matrix" on page 262 and reset the pump hours.

To reset pump hours, select **`Reset Pump Hours`** from the **`Setup Gas Analyzer`** menu in the monitor's service mode. Confirm when prompted.

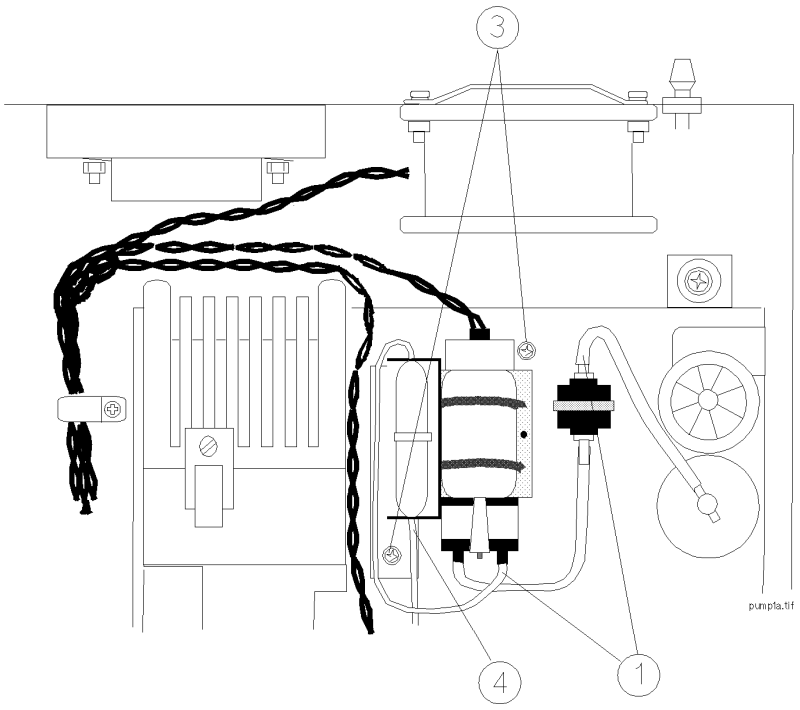


Figure 75 Replacing the Pump

Fan

Removal

To remove the fan (refer to Figure 76 and Figure 77):

1 Ensure that the Anesthetic Gas Module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the power connector (1) from the main PC board.

3 Pry the twisted pair supplying power from the fan out of the cable clip (2).

4 Using a cross-tipped screwdriver, remove the four screws and washers (3) securing the fan and the grill to the back panel of the module.

5 Remove the fan and connecting cable from the module.

Replacement

To replace the fan (refer to Figure 76 and Figure 77):

1 Ensure that the Module is switched off and isolated from the mains power supply.

Replace the fan and connecting cable.

2 Replace the four screws and washers (3) that secure the fan into the back panel of the module.

3 Snap the twisted pair from the fan into the cable clip (2) securing the twisted pairs that connect the IR measurement head with the main PC board.

4 Replace the connector (1) to the main PC board.

5 Replace the top cover of the module.

Now perform the performance checks described in the “Test and Inspection Matrix” on page 262.

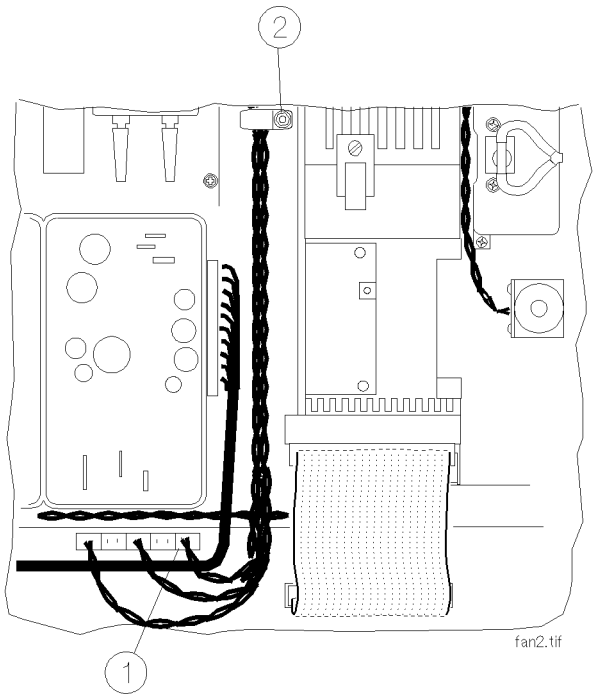


Figure 76 Removing the Fan Cabling

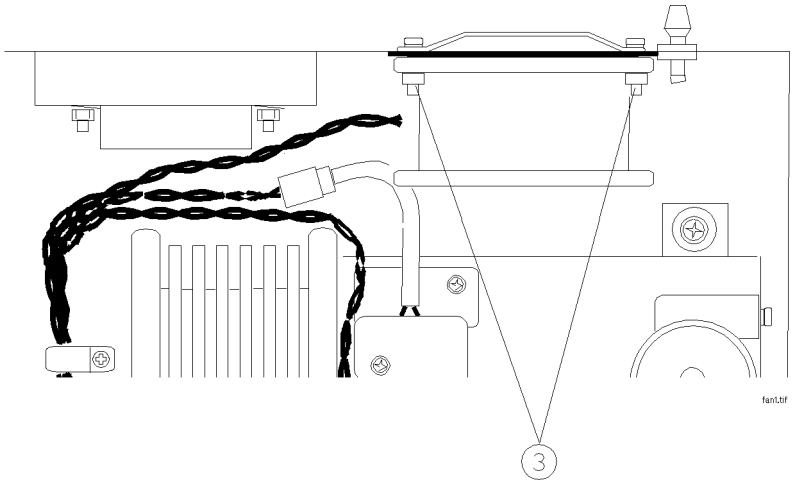


Figure 77 Removing the Fan

Solenoid Valve #2

Removal

To remove solenoid valve #2 (refer to Figure 78):

1 Ensure that the Module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the pneumatic tubing (1) from solenoid valve #2.

3 Remove the connection (2) from the main PC board.

4 Using a cross-tipped screwdriver, remove the two screws (3) securing the solenoid valve to its bracket.

5 Remove solenoid valve #2.

Replacement

To replace solenoid valve #2 (refer to Figure 78):

1 Ensure that the Module is switched off and isolated from the mains power supply.

2 Position the solenoid valve on its bracket so that the locating holes on the valve align with threaded bores in the bracket.

3 Using a cross-tipped screwdriver, replace the two screws (3) securing the solenoid valve to its bracket.

4 Replace the connection (2) to the main PC board.

5 Replace the pneumatic tubing (1) to solenoid valve #2. Check that all tubing is tightly connected and show no signs of damage.

NOTE After replacing solenoid valve #2, check that all flat-cable connectors are firmly seated and show no signs of damage.

6 Replace the top cover of the module.

Now perform the performance checks described “Test and Inspection Matrix” on page 262.

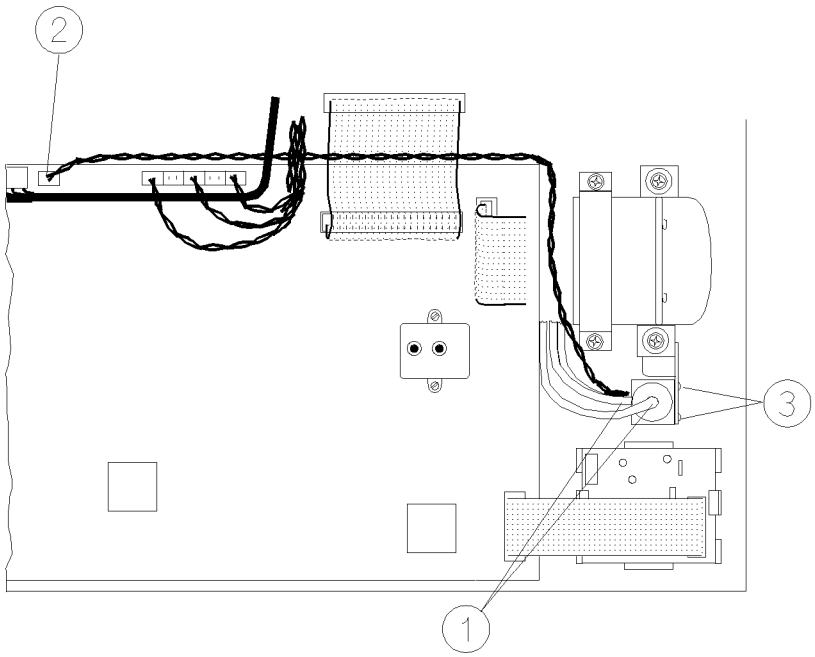


Figure 78 Removing the Solenoid Valve #2

Top Cover PC Board

Removal

To remove the top cover PC board (refer to Figure 79 and Figure 80):

1 Ensure that the Module is switched off and isolated from the mains power supply. Remove the top cover of the module.

2 Remove the connector (1) from the top cover PC board.

3 Using a hex-socket screwdriver, remove the three nuts, washers and spacers (2) securing the PC board to the top cover of the module.

4 Remove the PC board.

Replacement

To replace the top cover PC board (refer to Figure 79 and Figure 80):

1 Ensure that the Module is switched off and isolated from the mains power.

2 Carefully fit the PC board over the three locating screws on the top cover of the module.

3 Using a hex-socket screwdriver, replace the three nuts, washers and spacers (2) securing the PC board to the top cover.

4 Replace the connector (1) to the top cover PC board.

5 Replace the top cover of the module.

Now perform the performance checks described “Test and Inspection Matrix” on page 262.

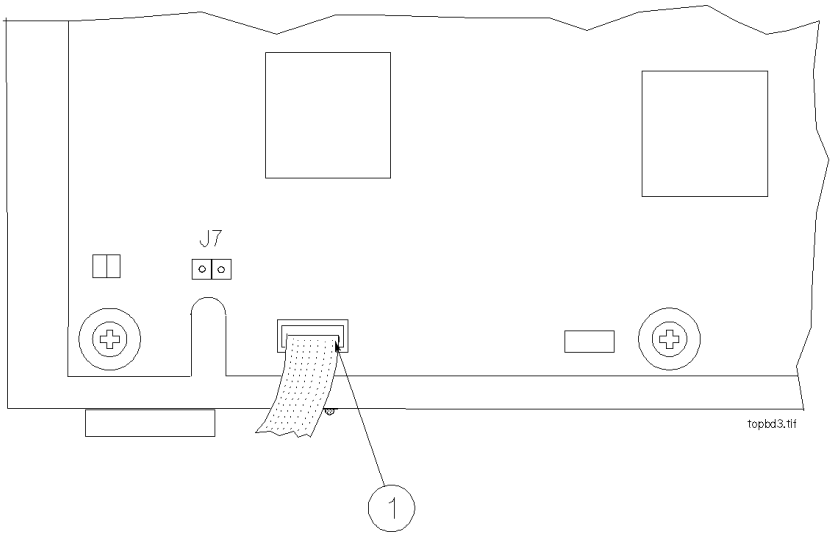


Figure 79 Removing the Top Cover PC Board Connection

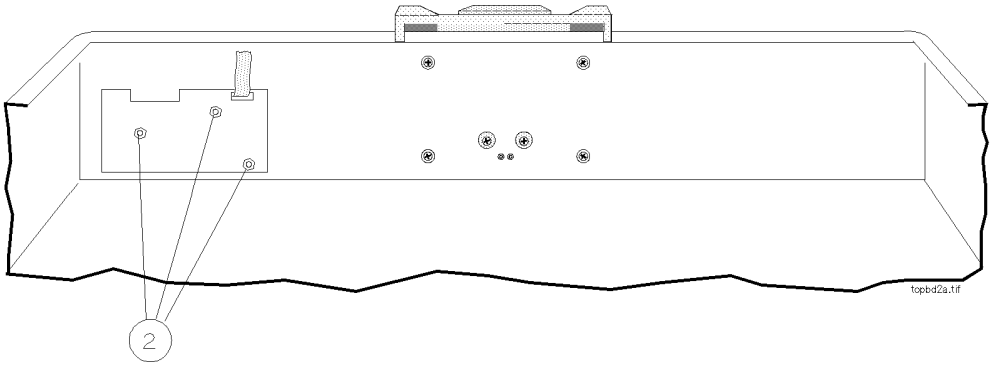


Figure 80 Removing the Top Cover PC Board

Watertrap Manifold and Protector

Removal

To remove the manifold and protector (refer to Figure 81):

1 Remove the top cover of the module.

2 Remove the Nafion tubing and purple connector tubing from the manifold connectors (1) on the inside of the front cover.

3 Using a cross-tipped screwdriver, unscrew the 4 screws (2) securing the protector to the front cover and remove the protector.

4 Using a cross-tipped screwdriver, unscrew the 2 screws (3) securing the manifold to the protector.

Replacement

To replace the manifold and protector (refer to Figure 81):

1 Using a cross-tipped screwdriver, replace the 2 screws securing the manifold to the protector.

2 Using a cross-tipped screwdriver, replace the 4 screws securing the protector to the front cover.

3 Replace the Nafion tubing and purple connector tubing onto the manifold connectors on the inside of the front cover. Take care to attach the tubing with the red mark at the end to the connector with the red marking (this indicates the “drainage” path). The gap between the end of the nafion tubing and the manifold connectors (visible through the purple connector tubing) must be less than 1mm.

Now perform the performance checks described “Test and Inspection Matrix” on page 262.

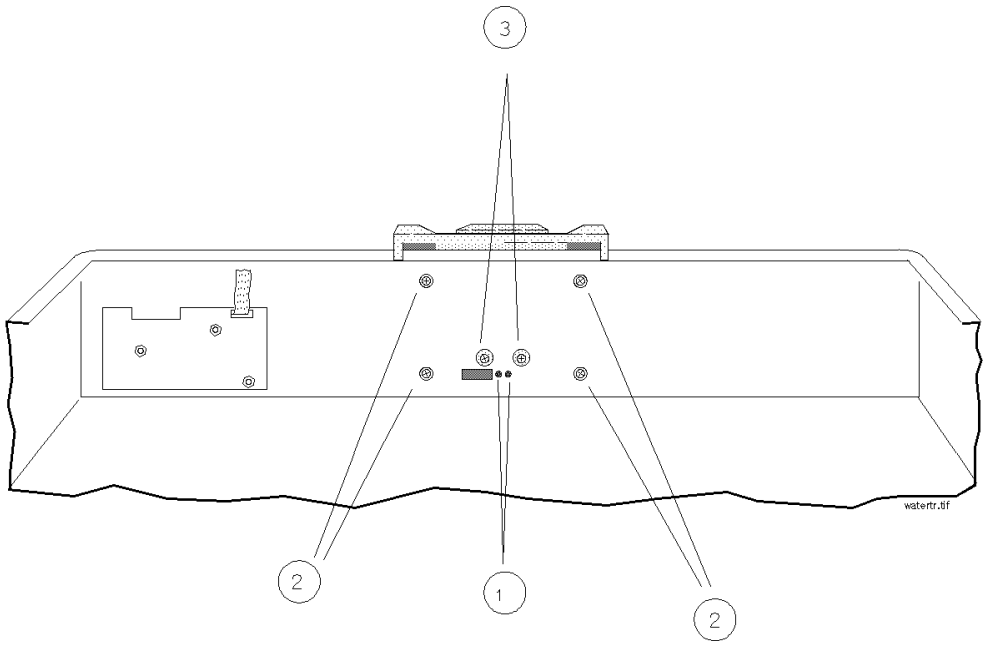


Figure 81 Removing the Watertrap Manifold and Protector

Power Fuses

Removal

To remove the power fuses (refer to Figure 82):

1 Using a flat-tipped screwdriver, unscrew the fuse counter-clockwise (1).

2 Pull the fuse cap and fuse clear of the display.

3 Pull the fuse out of the fuse cap and note the fuse rating.

4 Repeat the steps for the other fuse.

Replacement

To replace the power fuses (refer to Figure 82):

1 Put one end of the fuse into the fuse cap.

2 Put the fuse and fuse cap into the receptacle in the rear of the display.

3 Using a flat-tipped screwdriver, screw the fuse clockwise into the receptacle.

4 Repeat the steps for the other fuse.

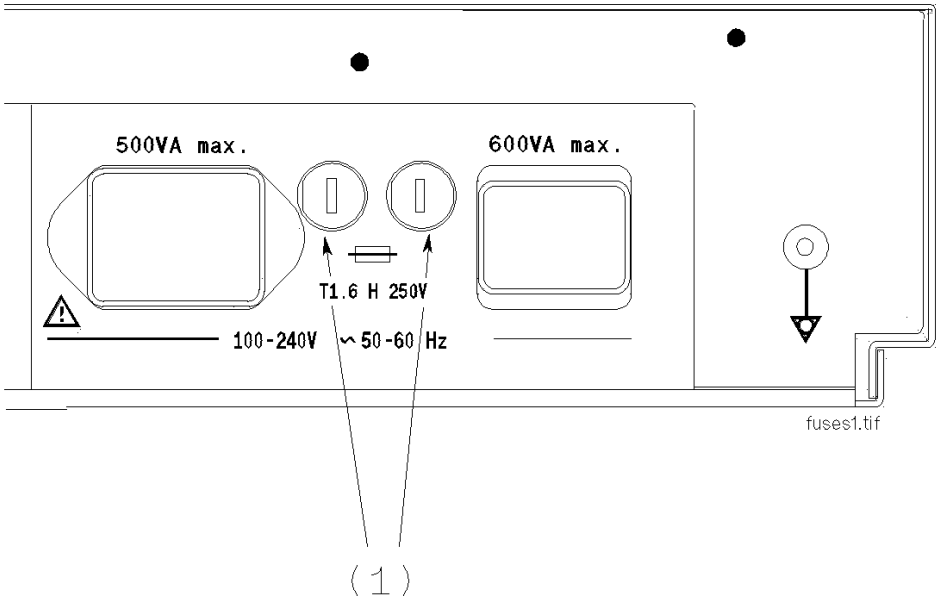


Figure 82 The Power Fuses

Test and Inspection Matrix

The Test and Inspection Matrix describes:

- which tests need to be performed
- the expected test results
- what should be written by Philips service personnel on the Philips Installation Report or Customer Service Order (CSO).

The second section *When to Perform Test Blocks* describes when the tests should be performed.

These tables should be followed for all installations and repairs.

NOTE The test procedures outlined for this test block are to be used only for verifying safe installation or service of the product in question. The setups for these tests and the acceptable ranges or values are derived from local and international standards but may not be equivalent. These are not a substitute for local safety testing where it is required for an installation or service event.

Test Block Name	Test or Inspection to be performed	Expected Test Result	What to Record on Service Record
Visual	Check for any mechanical damage and all external leads and accessories. Is the device free of damage and are all accessories properly set up?	Expected answer is "yes". If so, visual test is passed.	V: P or V: F where P=Pass and F=Fail
Power On	Switch on the module. A built-in selftest and communication test are running for two minutes after "Power On". The green setup LED near the power button indicates by flashing if one of the tests failed. When tests are successfully completed after 2 minutes the LED is off and the AGM will enter warmup mode (indicated by INOP "GA.WARMUP"). Does AGM boot up successfully without displaying any error or malfunction messages?	Expected answer is "yes". If so, PowerOn test is passed.	PO: P or PO: F where P=Pass and F=Fail
Performance Leakage Check	Perform Leakage Check	Measured flow value: 0-4 ml/min	PL: P or PL: F where P=Pass and F=Fail

Test Block Name	Test or Inspection to be performed	Expected Test Result	What to Record on Service Record
Performance Flowrate Check	Perform Flowrate Check. Document the actual flowrates.	Flowrates M1026A #A02/#A05: Purge = x1 (310 +/- 15 ml/min) Measurement Path = x2 (labelled value +/- 3 ml/min) Normal = x3 (132 - 170 ml/min)	PF: P/x1/x2/x3 or PF: F/x1/x2/x3 where P=Pass and F=Fail
Performance Diagnostic Check	Perform the Diagnostic/Error Check. Does the status of each subassembly display as "OK" in **`Gas Analyzer Diagnostic`** window? The subassemblies are: - Meas. Assembly - Meas. Opt. Path - Agent-ID - O2 Assembly - Main PCB - Power Supply - Pneumatic System - Operat. Temperature	Expected answer is "yes". If so, Error/Diagnostic check is passed.	PD:P or PD:F where P=Pass and F=Fail
Performance Zero Calibration Check	Does the status of each channel display as "OK" in the **`Gas Analyzer Calibration`** window after zero calibration? The channels are: - Press - O2 - CO2 - N2O - Subst.	Expected answer is "yes". If so, zero calibration check is passed.	PZC:P or PZC:F where P=Pass and F=Fail

Test Block Name	Test or Inspection to be performed	Expected Test Result	What to Record on Service Record
Performance Barometric Pressure Check	Perform Barometric Pressure Check .	Difference between actual measured pressure value and actual ambient pressure value = x (<= 5 mmHg)	PBP:P/x or PBP:F/x where P=Pass and F=Fail
Performance Span Calibration Check	Perform the Span Calibration Check. Document the actual measured values for each gas channel. If failed (out of specified tolerances) - perform a span calibration for specific gas channel.	O2 value = x1 (+- 1.0% to O2 calibration value) CO2 value = x2 (+- 0.1% to CO2 calibration value) N2O value = x3 (+- 2.0% to N2O calibration value)) Agent value = x4 (+- 0.1% to Agent value) When calibration of EACH gas channel was necessary, status of each channel shows "Done". Result to report in this case is PSH:P (without individual gas value results)	PSH:P/x1/x2/x3/x4 or PSH:F/x1/x2/x3/x4 where P=Pass and F=Fail alternatively PSH:P or PSH:F where P=Pass and F=Fail
Performance Normal Operation Check	Enter Monitoring mode and check that all AGM related waves and numerics are present and correspond to the user's configuration. Are all AGM waves and numerics present according to the user's configuration?	Expected answer is "yes". If so, performance normal operation check is passed.	PNO: P or PNO: F where P=Pass and F=Fail
Performance Pump Test	Using the pump test kit provided in the PM kit, clean and test the pump according to the included instructions. Did the pump pass the test?	Expected answer is "yes". If so, test is passed.	PPU: P or PPU: F where P=Pass and F=Fail
Performance Fan Check	Check that the cooling fan runs smoothly. Did the fan pass the test?	Expected answer is "yes". If so, fan check is passed.	PFA: P or PFA: F where P=Pass and F=Fail

Test Block Name	Test or Inspection to be performed	Expected Test Result	What to Record on Service Record
Safety	Step 1 Protective Earth. See Safety Test Appendix for details / S (2). Step 2 Enclosure Leakage Current - Normal Condition. See Safety Test Appendix for details / S (4). Step 3 Enclosure Leakage Current - S.F.C. Open Supply. See Safety Test Appendix for details / S (5). Step 4 Enclosure Leakage Current - S.F.C. Open Earth. See Safety Test Appendix for details / S (6).	With mains cable: Maximum impedance = x1 (<= 100 mOhms) Maximum leakage current = x2 (<= 100 uA) Maximum leakage current = x3 (<=500uA) (<= 300 uA, for US and/or UL devices) Maximum leakage current = x4 (<=500uA) (<= 300 uA, for US and/or UL devices)	S:P/x1/x2/x3/x4 or S:F/x1/x2/x3/x4 where P=Pass and F=Fail

When to Perform Test Blocks

Service Event **(When performing.....**	**Test Block(s) Required** **..... Complete these tests)**
Installation	Visual, Power On Performance Leakage Check, Diagnostic Check, Zero Calibration Check, Barometric Pressure Check, Span Calibration Check and Normal Operation Check
Repair/Parts replacement	Performance Leakage Check, Flowrate Check, Diagnostic Check, Zero Calibration Check, Barometric Pressure Check, Span Calibration Check and Normal Operation Check, Safety (whenever the topcover was opened)
Preventive Maintenance	Parts Replacement as described in Chapter 5 of the Anesthetic Gas Module Service Manual (part number M1026-9000B). Fan Check, Pump Test, Performance Leakage Check, Flowrate Check, Diagnostic Check, Zero Calibration Check, Barometric Pressure Check, Span Calibration Check and Normal Operation Check, Safety

Safety Test Appendix

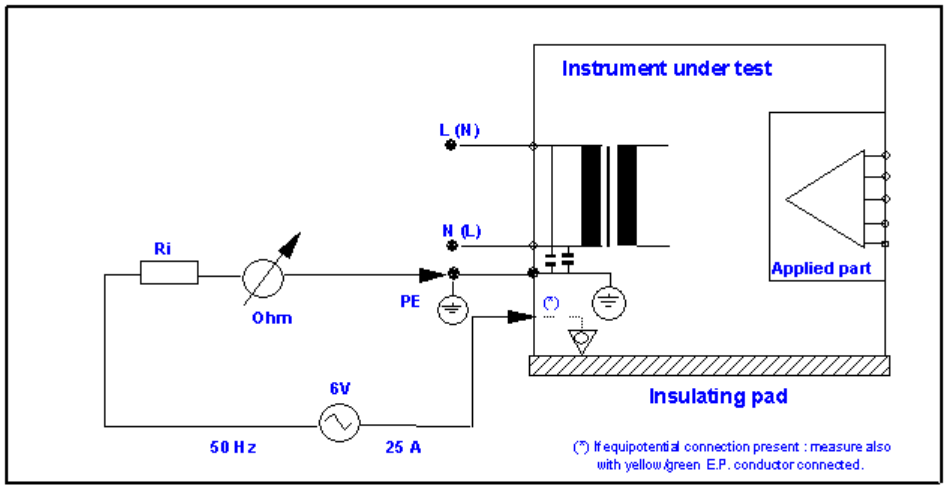
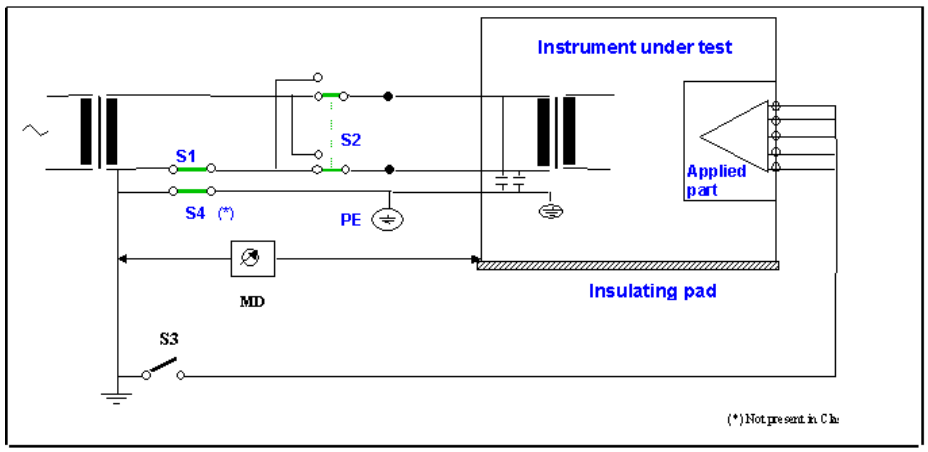
The test procedures outlined in this appendix are to be used **only** for verifying safe installation or service of the product in question.

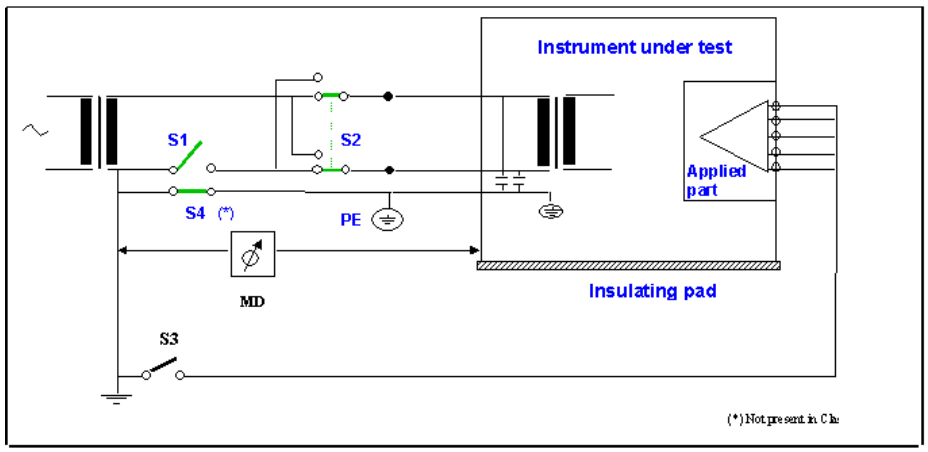
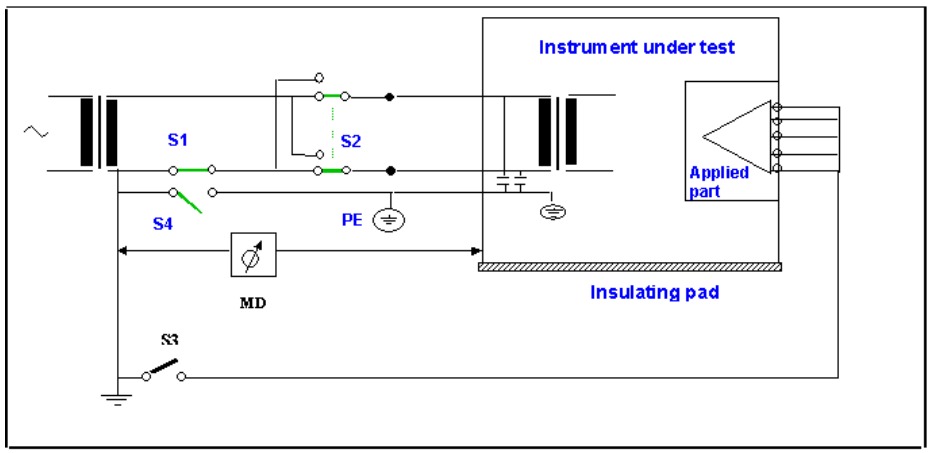
The setups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent.

These tests are **not a substitute for local safety testing** where it is required for an installation or a service event.

If using the Metron Safety tester use your local regulation to perform the test, *for example* in Europe IEC60601-1/IEC60601-1-1 and in the US UL2601-1. The Metron Report should print results with the names listed below, along with other data.

"Safety checks at installation refer to safety aspects directly related to the installaton and setup activities and not to intrinsic safety features that have already been checked during final acceptance testing at the factory".

Test Block name	Test or Inspection to perform
S(2) Protective Earth	
	Measures impedance of Protective Earth (PE) terminal to all exposed metal parts of Instrument under Test (IUT), which are for safety reasons connected to the Protective Earth (PE). Includes normally the wiring in the mains cable (max. 100 mOhm). Test current 25 Amps applied for 5 seconds to 10 seconds. The recommendation is to flex the main cable during the test in order to identify potential **bad** contact or damage of the earth wire. *Safety test according IEC 60601-1 (Clause 18)* Report largest value.
S(4) Test ENCL.1: Enclosure Leakage Current - NC (normal condition)	
	Applicable to Class 1 & 2 equipment, type B, BF & CF Applied Parts.Measures leakage current of exposed metal parts of UIT; normal and reversed polarity using S2. For type BF & CF Applied Parts measures with AP/GND switch S3 open and closed. *Safety test according to IEC 60601-1 (Clause 19.4g)* Report largest value.

Test Block name	Test or Inspection to perform
S(5) Enclosure Leakage Current – Single Fault Condition Open Supply	
	Applicable to Class 1 & 2 equipment, type B, BF & CF Applied Parts.Measures leakage current of exposed metal parts of IUT with one supply lead interrupted (S1=open); normal and & reversed polarity using S2. For type BF a& CF Applied Parts measures with AP/ GND switch S3 open and closed. *Safety test according to IEC 60601-1 (Clause 19.4g)*Report largest value.
S(6) Enclosure Leakage Current - Single Fault Condition Open Earth (Ground)	
	Applicable to Class 1 equipment, type B, BF, & CF Applied Parts. Measures leakage current of exposed metal parts of UIT with Protective Earth open-circuit (S4=open); normal & reversed polarity using S2. For type BF & CF Applied Parts measures with with AP/GND switch S3 open and closed. *Safety test according to IEC 60601-1 (Clause 19.4g)* Report largest value.

Parts List

This chapter provides the replacement and exchange part numbers (if available) for the Philips M1026A Anesthetic Gas Module and calibration equipment. Refer to Figure 83 and the following table to identify the part and part number.

The circuit boards used in the Anesthetic Gas Module contain Surface Mounted Devices (SMD) which can only be repaired with special equipment, not available in the field. For this reason, the majority of the parts used in the system can only be replaced at board level.

When ordering a part, please refer to Appendix A for addresses and contact information.

Table legend:

R	Replacement Part
E	Exchange Part
Std.A-ID	Standard Agent Identification
Ext.A-ID	Extended Agent Identification

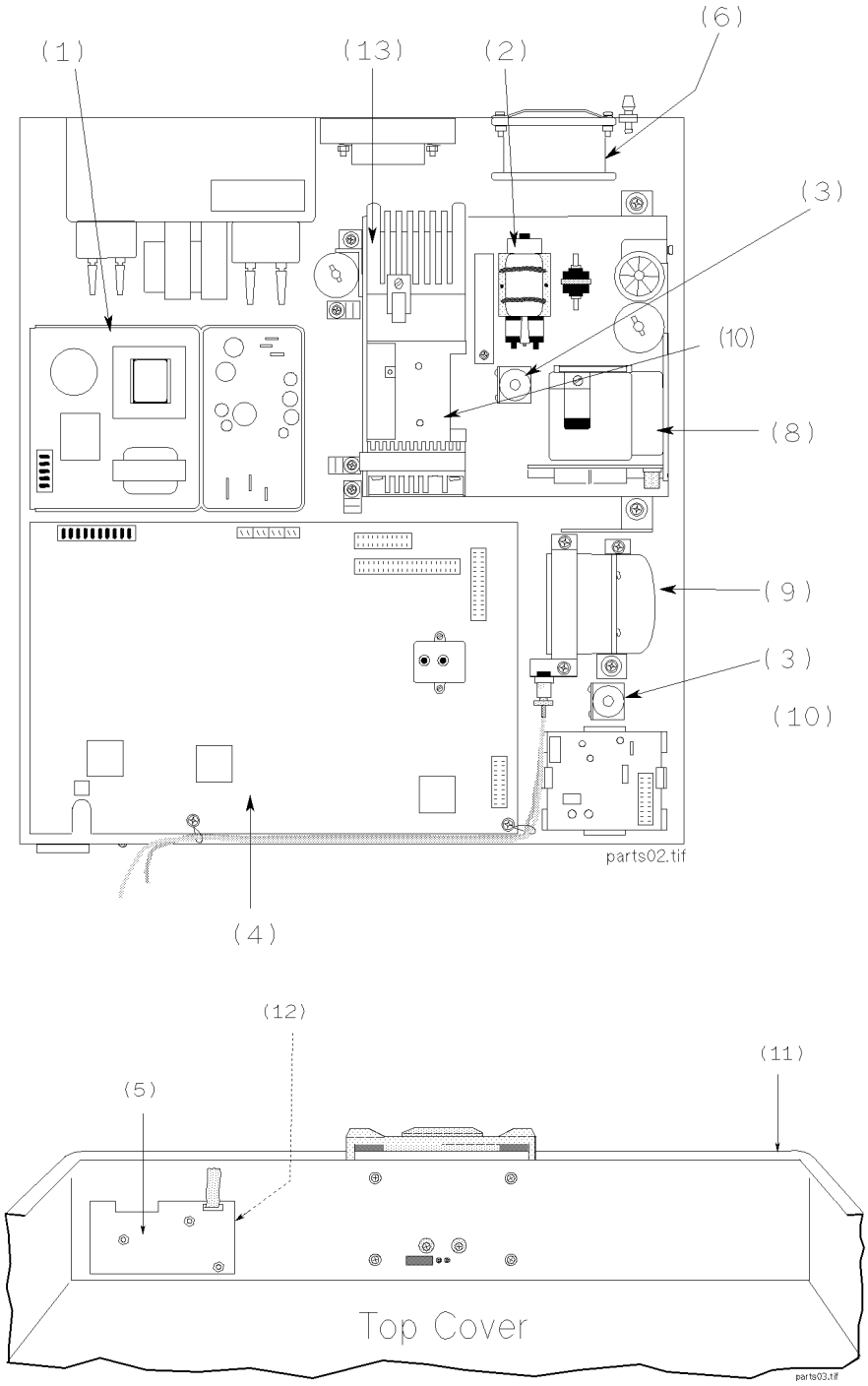


Figure 83 Replacement Parts

Part Number	Description	R/E
M1026-60100	Power Supply, 2 output, 3A, 120mA	R
M1026-60330	Pump Assy.	R
M1026-60102	Solenoid Valve Assy.	R
M1026-60503	Main PCB (fully loaded) for 5 Agent-ID	R
M1026-69503	Main PCB (fully loaded) for 5 Agent-ID	E
M1026-60105	Front Panel PCB	R
M1026-60106	Fan, 12Vdc	R
M1026-60510	M1026A 5 Agent Identification (A-ID)	R
M1026-69510	M1026A 5 Agent Identification (A-ID)	E
M1026-60138	Oxygen Sensor Assy. w/ integrated pcb	R
M1026-69138	Oxygen Sensor Assy. w/ integrated pcb	E
M1026-60112	Sample Cell	R
M1026-60135	Top cover	R
M1026-60108	IR Assembly Kit	R
M1026-69108	IR Assembly Kit	E

Part Number of Kit	Description	R/E
M1026-60132	Preventive Maintenance Kit. Includes:	
	Nafion tubing with internal bacterial filters	
	Room air filter	
	Pump outlet filter	
	Pump test tubing	
	Watertrap manifold seals	
M1026-60119	Tubing Kit. Includes:	R
	Tubing 1/8 in. ID x 3/16 in. OD (1 ft.)	
	Tubing 1/32 in. ID x 3/32 in. OD (5 ft.)	
	Tubing 039 in. ID x 120 in. OD (5 ft.)	
	Tubing 060 in. ID x 187 in. OD (5 ft.)	
	Tubing 1.14 mm ID x 1.57 mm OD (5 ft.)	
	Tube fitting, Tee for 1/16 in. tubing (Qty=2 per AGM)	
	Tube fitting, Tee for 1/16 in. ID & 1/8 in. ID tubing (Qty=1 per AGM)	
	Pulse dampener kit, with T-fitting	
	Flow-control tubing assembly	
	Flow restriction kit	
M1026-60120	Power Button Kit (5 pieces). Includes:	R
	Power button	
	Power button switch	
	Coupler, power switch	
	Shaft, short, power switch	
	Pushrod, power switch	
M1026-60121	Power Module Kit. Includes:	R
	Filter, Power Line, 1.5A, 250V	
	Assy. Daisy chain power	
	Assy. Power entry module	
	Assy. Harness, AC power-filtered	
	Assy. Harness, AC power unfiltered, black	
	Assy. Harness, AC power unfiltered, white	

Part Number of Kit	Description	R/E
M1026-60122	Cable Kit (6 pieces). Includes:	R
	Cable, Assy. 9 pin (power supply to PCB)	
	Cable, Assy. Flat. 40 pin (4710 head to PCB)	
	Cable, Assy. Flat, 26 pin (4740 head to PCB)	
	Cable, Assy. Flat, DB25 to 26 pin (RS232/ PCB)	
	Cable, Assy. Flat, 16 pin (O2 PCB to PCB)	
	Cable, Assy, 2 pin with LED	
M1026-60123	Rubber Spacer Kit	R
M1026-60127	Main EPROM	R
M1026-60133	WT Manifold kit	R
M1026-60134	WT Protector kit	R
M1026-60136	Flow Split Test Kit	R
2110-0495CP	Fuses	R

Calibration Equipment

The following table lists the part numbers for the calibration equipment. Calibration procedures are explained in Chapter 4.

Part Number	Description
M1026-60144	Electronic Flow meter
M1657B	Watertrap
M1658A	Sample Tubing
M1659A	Calibration Tube Assembly
M1660A[1]	Calibration Gas Assembly (3% Halocarbon 22, 5% CO_2, 40% N_2O, 52% O_2)

1.This Calibration Gas Assembly cannot be ordered in Japan; use Scott Medical Products DOT29M1060 instead.

Previous part number	New part number	Effective Date
M1026-60101 Pump assy., square-shaped	**M1026-60130 Pump assy., round-shaped**	**August 1997**
M1026-60111 Oxygen Sensor assy. with PC board separate	**M1026-60138 Oxygen Sensor assy. with PC board integrated in housing**	**June 1998**
M1026-60110 Ext.Agent-ID	**M1026-60210 Ext. Agent-ID**	**October 1998**
M1026-60130 Pump Kit	**M1026-60230 Pump Kit**	**June 1999**
M1026-60230 Pump Kit	**M1026-60330 Pump Kit**	**April 2000**

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